Dissertation On

"A COMPARISON OF AXILLARY APPROACH AND HUMERAL APPROACH FOR FOUR- INJECTION BRACHIAL PLEXUS BLOCK USING PERIPHERAL NERVE STIMULATOR"

Submitted To

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

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GOVERNMENT STANLEY MEDICAL

COLLEGE & HOSPITAL

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI, TAMILNADU

APRIL- 2012

CERTIFICATE

This is to certify that this dissertation entitled **"A COMPARISON OF AXILLARY APPROACH AND HUMERAL APPROACH FOR FOUR INJECTION BRACHIAL PLEXUS BLOCK USING PERIPHERAL NERVE STIMULATOR"** is bonafide record work done by **DR.V.P.SENTHIL KUMAR** under my direct supervision , submitted to The Tamil Nadu Dr. M.G.R. Medical University in partial fulfilment of university regulation for MD, BRANCH X –ANAESTHESIOLOGY.

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DECLARATION

I **DR.V.P.SENTHIL KUMAR** solemnly declare that this dissertation titled **"A COMPARISON OF AXILLARY APPROACH AND HUMERAL APPROACH FOR FOUR INJECTION BRACHIAL PLEXUS BLOCK USING PERIPHERAL NERVE STIMULATOR"** has been done by me. I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree, diploma to any other university board either in india or abroad.

This is submitted to The Tamilnadu Dr. M. G. R. Medical University, Chennai in partial fulfillment of the rules and regulation for the award of DOCTOR OF MEDICINE DEGREE BRANCH –X (ANAESTHESIOLOGY) to be held in APRIL -2012.

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CONTENTS

INTRODUCTION

Peripheral nerve blocks have been increasingly recognized as the technique of choice for providing anesthesia and postoperative analgesia. The use of peripheral nerve blocks have reduced the consumption of opioids and the length of hospital stay. Peripheral nerve blocks are also used as a treatment modality in acute and chronic pain management.

Peripheral nerve block for the upper limb surgical procedures can be done by blocking the brachial plexus. This can be done at the level of root, trunk, division , cord or terminal nerves. The different approaches are available namely interscalene approach, supraclavicular approach, infraclavicular approach ,axillary approach and humeral approach . The choice of the approach depends on the patient's condition, the surgical indication, and the anesthesiologist's experience.

The axillary approach of the brachial plexus block is one of the most widely used regional anesthesia techniques for surgical procedures involving the hand, forearm, and elbow. This approach have a high success rate with less reported complications. Various techniques like transarterial technique, parasthesia technique, peripheral nerve stimulator technique and ultrasound guided technique are available for performing the axillary block.

The humeral approach is a recently introduced technique of multiple nerve blocks at the level of the humeral canal using the peripheral nerve stimulator.

This approach provides a selective block of each major nerve from the brachial plexus and results in a high success rate .

The study comparing the humeral block with a conventional axillary block was conducted by Bouaziz et al(2). who found that the humeral approach provided a greater success rate than the axillary approach .They compared a four-injection technique at the humeral level with a two-injection axillary block in which only the musculocutaneous and another nerve innervating the surgical site were located and injected. Several other studies of axillary approach of brachial plexus demonstrated that a four-injection technique produced a rapid onset and frequent success.

On the basis of these results, we thought that a comparison between the axillary approach and humeral approach would be more valid. Therefore, we conducted this prospective, randomized study to compare the axillary approach and the humeral approach of the brachial plexus block.

AIM OF THE STUDY

To compare the onset time and success rate of axillary approach and humeral approach for four injection brachial plexus block using peripheral nerve stimulator in patients undergoing surgery in forearm, wrist and hand.

HISTORY(39)

Regional anaesthesia traces its origin to Dr.Carl Koller, a young Viennese Ophthalmologist, who in 1884 employed a solution of cocaine for topical corneal anaesthesia in patients undergoing eye surgeries.

Brachial Plexus block was first performed by William Stewart Halsted in 1889. He directly exposed the brachial plexus in the neck to perform the block and cocaine was used for the procedure.

1n 1911,Hirschel first described the percutaneous approach to the brachial plexus.

The axillary brachial plexus block is the most commonly performed technique of brachial plexus anesthesia. This technique was first described by Hirschel in 1911.

The single injection perivascular axillary technique as described by Winnie.

The humeral block was first described by Dupre in 1994.

ANATOMICAL CONSIDERATIONS(39,43)

Brachial plexus supplies sensory and motor innervations to the upper limb. Understanding the formation of the brachial plexus and its distribution is essential

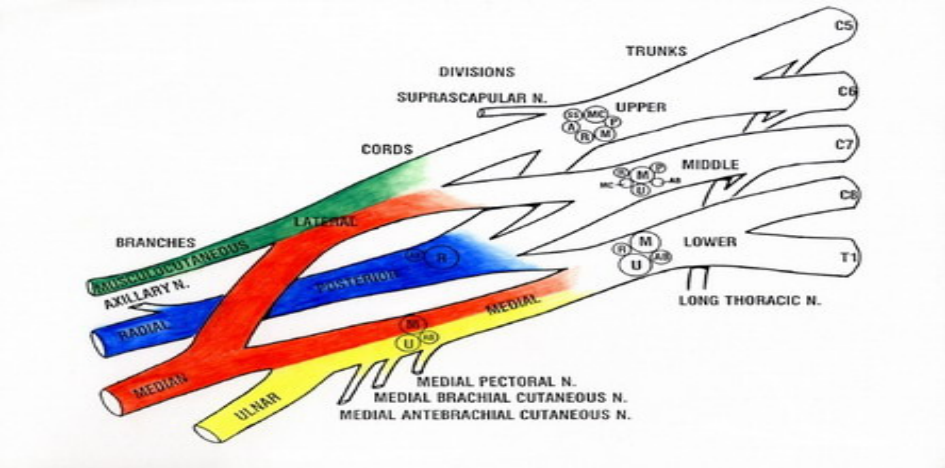
for the effective use of the brachial plexus blockade for the surgeries of the upper limb.

Anatomy of the Brachial Plexus

The brachial plexus is formed by the union of the anterior primary divisions (ventral rami) of the fifth through the eighth cervical nerves and the first thoracic nerves . Contributions from C4 and T2 are often minor or absent. As the nerve roots leave the intervertebral foramina, they converge, forming trunks, divisions, cords, and then finally terminal nerves. Three distinct trunks are formed between the anterior and middle scalene muscles. Because they are vertically arranged, they are termed superior, middle, and inferior. The superior trunk is predominantly derived from C5–6, the middle trunk from C7, and the inferior trunk from C8–T1. As the trunks pass over the lateral border of the first rib and under the clavicle, each trunk divides into anterior and posterior divisions. As the brachial plexus emerges below the clavicle, the fibers combine again to form three cords that are named according to their relationship to the axillary artery: lateral, medial, and posterior. The lateral cord is the union of the anterior divisions of the superior and middle trunks; the medial cord is the continuation of the anterior division of the inferior trunk; and the posterior cord is formed by the posterior division of all three trunks. At the lateral border of the pectoralis minor muscle, each cord gives off a large branch before terminating as a major terminal nerve. The lateral cord gives off the lateral branch of the median nerve and

terminates as the musculocutaneous nerve; the medial cord gives off the medial branch of the median nerve and terminates as the ulnar nerve; and the posterior cord gives off the axillary nerve and terminates as the radial nerve.

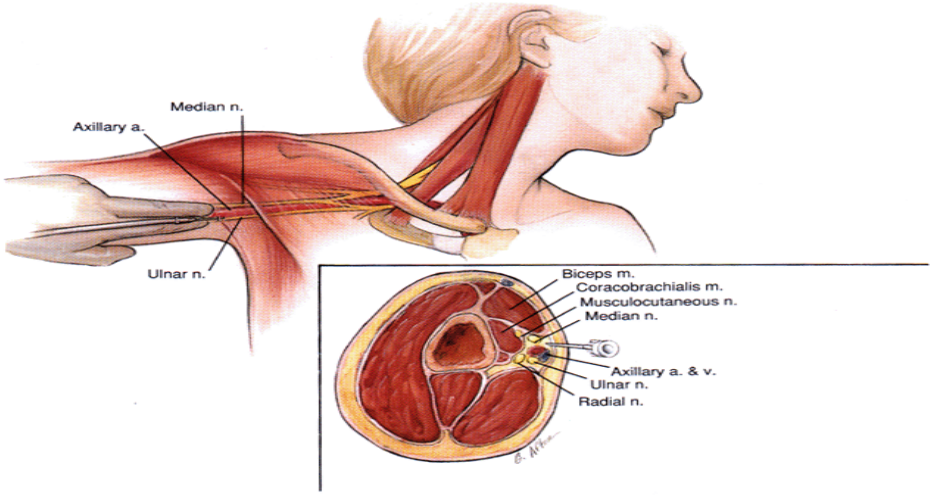
Some areas of the anterior shoulder are innervated by the superficial cervical plexus (C1–4). The medial brachial cutaneous (C8–T1) and intercostobrachial (T2) nerves must also be blocked separately to reliably prevent pain from an arm tourniquet. They innervate the skin of the medial and posterior proximal upper arm .



Axillary Region

At the level of the axilla, the axillary artery is surrounded by the median, radial, and ulnar nerves within the neurovascular sheath. The position of the nerves relative to the artery is variable. The musculocutaneous nerve leaves the axilla more proximally and enters the coracobrachialis muscle. The radial nerve is

usually found posterior to the artery, the ulnar nerve lies on the inferior or posterior border of the artery, and the median nerve lies superior to the artery.

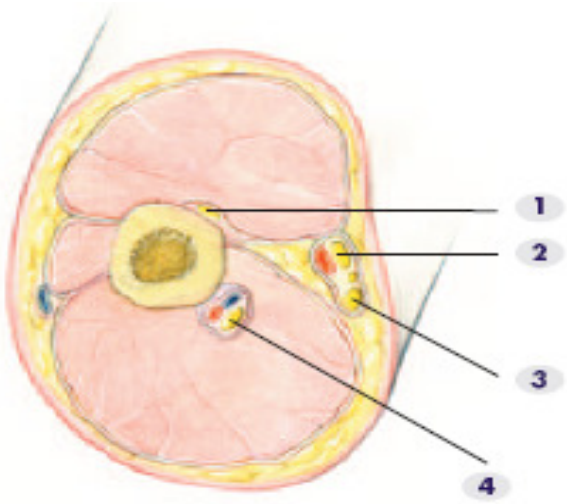


Humeral region

At the level of the brachial canal, the median, ulnar, radial, and musculocutaneous nerves are dispersed around the brachial artery. The median nerve usually runs anterior and superior to the brachial artery, while the musculocutaneous nerve runs posterior and superior to the median nerve in a groove between the biceps and coracobrachialis muscle. The ulnar nerve runs medial to the brachial artery, and the radial nerve runs medial and posterior, between the triceps muscle and the medial border of the humerus. The closer to the elbow, the more separated are the nerves.

1 musculocutaneous n.
2 median n.
3 ulnar n.
4 radial n.

All individual blocks performed via one single skin puncture.



AXILLARY BLOCK(44,45)

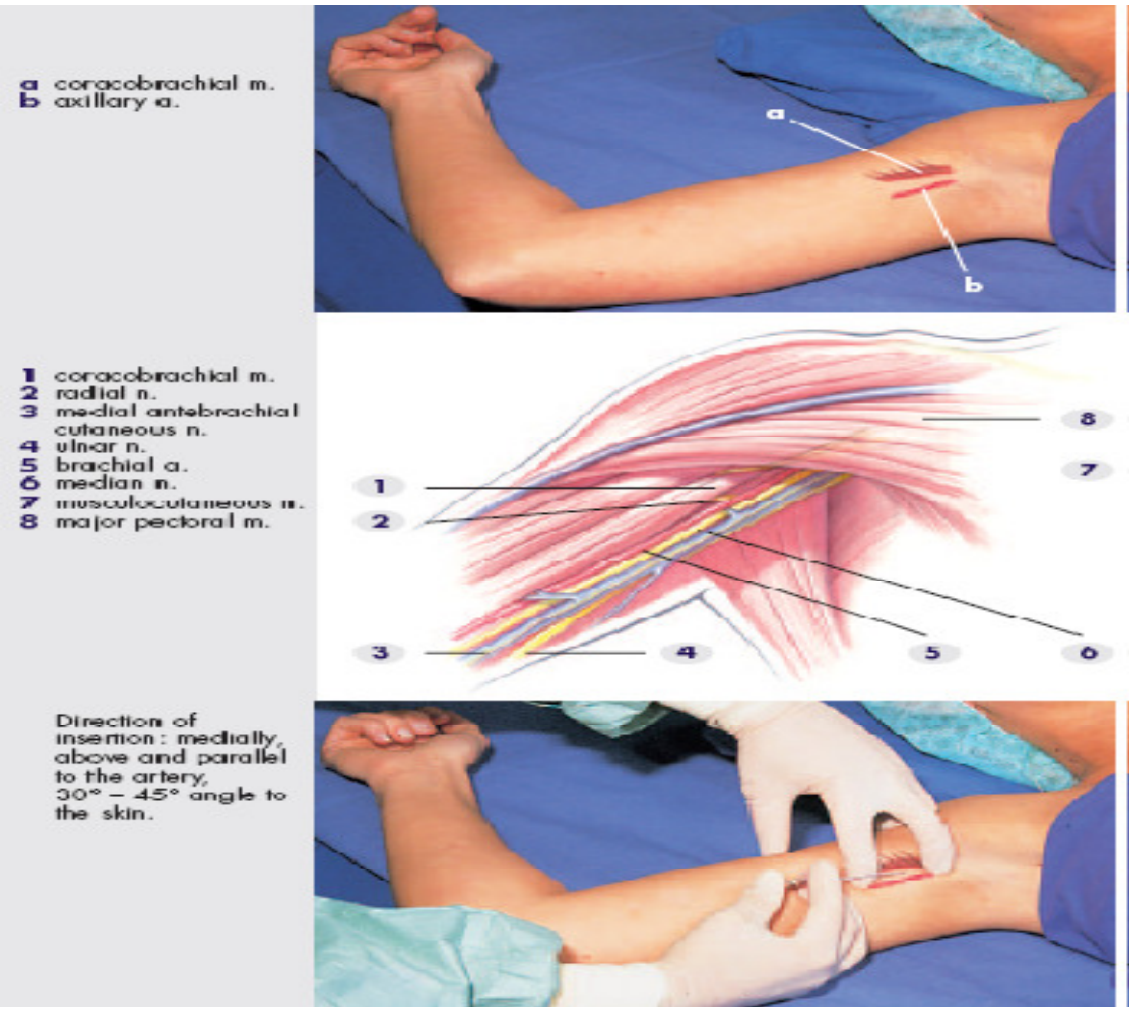
Patient position: supine, with the arm to be blocked abducted at 90° and the forearm flexed on the arm with another 90° angle while the head is slightly turned toward the contralateral side.

Needle size: 22-gauge, 50-mm insulated needle.

Volume: 5 ml per nerve.

Approach and technique: The axillary artery is identified and marked along with the inferior border of the major pectoralis muscle, and the coracobrachialis muscle. Then the insulated needle connected to a nerve stimulator with current of 1.5 milliamperes (mA), 2 Hertz(Hz), 0.1 milliseconds(ms) is introduced immediately above the axillary artery at a 45° angle as proximally as possible at the level of insertion of the long head of the biceps muscle in search of a stimulation of the median nerve (flexion of the fingers). After the proper stimulation is elicited, the position of the needle is adjusted to maintain the same motor response with a current ≤ 0.5 mA. After negative aspiration for blood, 5 ml of the anesthetic solution is injected slowly. The needle is then withdrawn to the level of the skin and the intensity of stimulating current is set back to 1.5 mA. The needle is redirected toward the coracobrachialis muscle at 30° and deeper in search of a stimulation of the musculocutaneous nerve. After the flexion of the forearm is elicited, the position of the needle is adjusted to maintain the same motor response with a current ≤ 0.5 mA. After negative aspiration for blood, 5 ml of the anesthetic solution is injected slowly. The needle is then withdrawn to the level of the skin, and the intensity of stimulating current is set back to 1.5 mA. The needle is reinserted through another skin puncture inferior to the axillary artery and perpendicular to the skin in search of the stimulation of the ulnar nerve (flexion of the fourth and fifth fingers with opposition of the first finger). The intensity of the current is progressively reduced to ≤ 0.5 mA. After a negative aspiration test, 5 ml of the local anesthetic solution is injected. The needle is

withdrawn from the skin and then redirected posteriorly to the axillary artery in search of the radial nerve (extension of fingers including the thumb). After the proper stimulation is elicited, the position of the needle is adjusted to maintain the same motor response with a current ≤ 0.5 mA. After negative aspiration for blood, 5 ml of the anesthetic solution is injected slowly.



HUMERAL BLOCK(44,45)

Patient position: supine, with the arm abducted at 90° and the forearm extended.

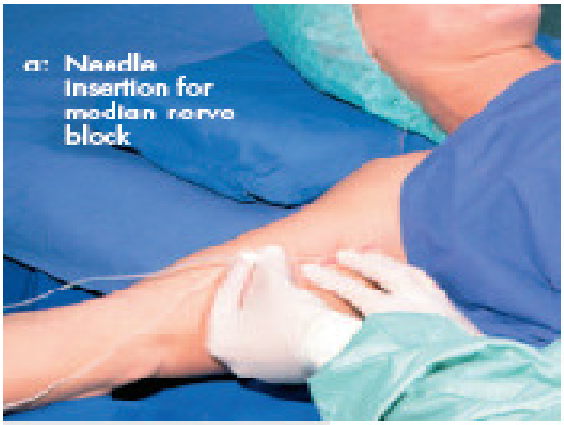
Indications: surgery at or below the elbow.

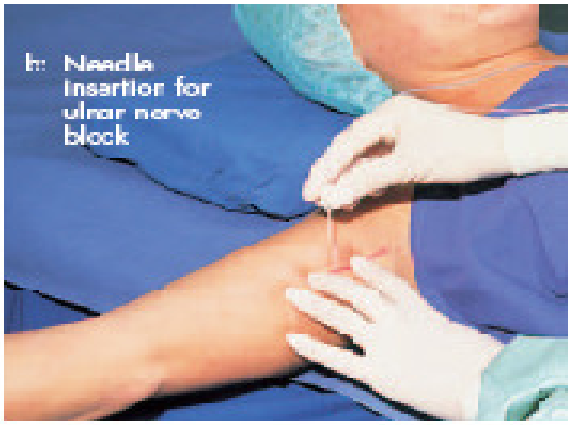
Needle size: 22-gauge, 50-mm b-beveled insulated needle.

Volume: 5 ml per nerve.

Approach and technique: First, a line is drawn over the brachial artery. The junction of the upper third and middle third of the arm over the brachial artery is marked. Then, a 22-gauge, 50-mm insulated needle connected to a nerve stimulator (2 mA, 2 Hz, 0.1 ms) is introduced almost tangentially to the skin, between the brachial artery and the palpating finger of the anesthesiologist, in the direction of the axilla in search of the median nerve . The stimulation of the median nerve induces a contraction of the flexor carpi radialis and flexor digitorum superficialis of the fingers (flexion of the fingers). Once this response is obtained, the position of the needle is adjusted to maintain the same motor response with a current of 0.3 to 0.5 mA. Then, 5 ml of local anesthetic is injected slowly. Next, the needle is withdrawn to the skin, the current is increased to 5 mA, and the needle is redirected in search of the ulnar nerve. The stimulation of the ulnar nerve induces a contraction of the flexor carpi ulnaris (flexion of the little finger and opposition of the little finger and thumb). Once this response is obtained, the position of the needle is adjusted to maintain the same motor response with a current of 0.3 to 0.5 mA. Then, 5 ml of local anesthetic is injected slowly. Next, the needle is withdrawn to the skin, the current is increased to 5 mA, and the needle is redirected in search of the radial nerve. The stimulation of the radial nerve induces a contraction of the extensor muscles,

including the extensor radialis (extension of the fingers and especially the thumb). Once this response is obtained, the position of the needle is adjusted to maintain the same motor response with a current of 0.3 to 0.5 mA. Then, 5 ml of local anesthetic is injected slowly. To block the musculocutaneous nerve, the needle is withdrawn to the skin and reintroduced in a superior and posterior direction toward the coracobrachialis muscle. The stimulation of the musculocutaneous nerve induces contraction of the biceps muscle (flexion of the forearm). Once this response is obtained, the position of the needle is adjusted to maintain the same motor response with a current of 0.3 to 0.5 mA . Then, 5 ml of local anesthetic is injected slowly. After disconnection of the nerve stimulator, 3 ml of local anesthetic is injected subcutaneously medially and laterally to the brachial artery to block the medial cutaneous nerve of the arm and the medial cutaneous nerve of the forearm.





1 musculocutaneous n.
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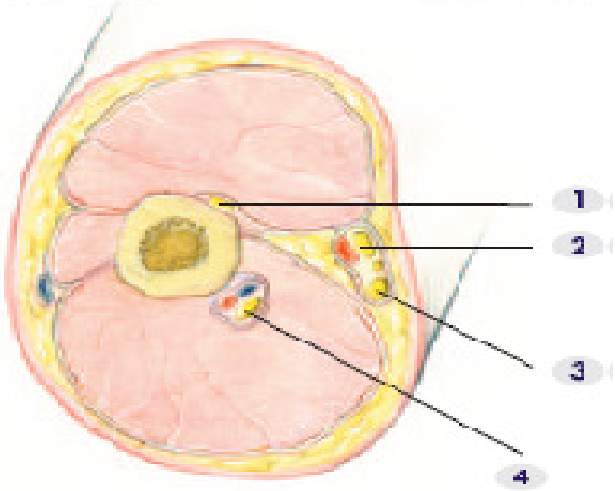

PHYSIOLOGICAL BASIS OF PERIPHERAL NERVE STIMULATOR TECHNOLOGY(40)

The ability of a nerve stimulator to evoke a motor response depends on the intensity, duration, and polarity of the stimulating current used and the needle (stimulus)-nerve distance. To propagate a nerve impulse, a threshold current must be applied to the nerve fibre. Peripheral nerve stimulation is typically performed using a rectangular pulse of current. When a square pulse of the current is used to stimulate a nerve, the total charge delivered is the product of the current strength and the duration of pulse. Stimulation intensity will be variable as determined by coulomb's law.

CHARACTERISTICS OF AN IDEAL PNS:

1. Constant current output-a particular current not the voltage stimulates the nerve. Therfore, the current delivered by the device should not vary with changes in the resistance of the external circuits.

2. Digital display of the delivered current
3. Variable output control
4. Clearly identifiable polarity
5. Option for different pulses
6. A wide range of current output 0.1-5.0ma
7. Battery indicator

PHARMACOLOGY (46,47,48,49,50,42,53)

(1)BUPIVACAINE

- It is amide local anaethetic drug**.**
- 95% bound to plasma proteins
- Peak concentration - 0.8 microgram/ml
- Toxic plasma concentration > 1.5 microgram /ml
- The toxic dose is 3 mg / kg.The drug acts in 10 to 20 minutes and has duration of action of 5 to 16 hours.
- **Uses:** Epidural and spinal anaesthesia, peripheral nerve blocks and infiltration analgesia
- It is more cardio toxic than lidocaine . It manifests clinically as ventricular tachyarrthymias and myocardial depression.

(2) LIGNOCAINE HYDROCHOLORIDE

- Lignocaine is chemically a tertiary amide, diethyl aminoacetyl, 2,6 xylidine hydrochloride monohydrate.
- Protein binding 70% and elimination half life 96 minutes
- Toxic plasma concentration: >5microgram/ml
- The toxic dose is 3 mg / kg without adrenalin and 7 mg / kg with addition of adrenalin.
- **Toxicity**

- ❖ Allergic reactions

- ❖ Presents with numbness of tongue and circumoral tissues, restlessness, vertigo, tinnitus, slurred speech, skeletal muscle twitching,tonic clonic seizures, CNS depression, hypotension and apnea.

- ❖ Decreases peripheral vascular resistance and myocardial contractility,producing profound hypotension and cardiovascular collapse.

- ➢ **Therapeutic uses:**

- ▪ Topical anaesthesic (2-4%),EMLA cream (lignocaine 2.5% prilocaine 2.5%),local infiltration and peripheral nerve block,intravenous regional anaesthetic (biers block),regional anaesthetic (spinal / epidural),stress attenuation and prevention of rise in intra cranial tension,suppression of the ventricular cardiac dysrhythmias.

(3) Adrenaline

Epinephrine (adrenaline) is the prototype drug among the sympathomimetics.It is an agonist of α- adrenergic, β 1 and β2 receptors.

Uses

- Added to local anaesthetic solution in order to decrease systemic absorption and to prolong duration of action.

- Treatment of life threatening allergic reaction.
- Used in cardiopulmonary resuscitation.
- Used as continuous infusion to increase myocardial contractility

REVIEW OF LITERATURE(1-38)

(1) SALVA TORE SIA, MD, ANTONELLA LEPRI, MD, et al.Four-injection brachial plexus block using peripheral nerve stimulator: A comparison between axillary and humeral approaches(ANESTH ANALG 2002;95:1075–9)

The prospective, randomized study to compare the success rate, performance time, and onset time of surgical anesthesia of a four-injection brachial plexus block performed at the axillary (group axillary; *n*=50) or at the humeral (group humeral; *n*=50) level using a peripheral nerve stimulator. All patients received 40 ml of a mixture of equal parts of 0.5% bupivacaine and 2% lidocaine. Four patients in group axillary and two in group humeral were excluded from the study because all of the four nerves were not localized in the allotted time. The incidence of complete block (91% versus 89%), defined as block of all the sensory areas below the elbow, and the onset time of sensory block (15 + / -6 minutes versus 16 +/- 7 minutes) were not different between the groups. The performance time was shorter in group humeral (7+/-2 min versus 8 +/- 2 min; $p < 0.005$). Block performance pain was lower in group axillary patients (16 +/- 9 minutes versus 23 +/- 12 minutes; $p < 0.005$).**Conclusion:**Both the axillary and the humeral approaches provide a high success rate and a rapid onset of sensory anesthesia; the differences found between the groups could be considered clinically unimportant.

(2) BOUAZIZ H et al. Comparison between conventional axillary block and a new approach at the midhumeral level.(ANESTH ANALG 1997;84:1058–62).

A prospective, randomized study to compare the success rate, time spent performing the blocks, onset time of surgical anesthesia, presence of complete motor blockade, and lidocaine plasma concentrations between conventional axillary block and a new approach at the midhumeral level. Both techniques were performed using a peripheral nerve stimulator. Two nerves were located at the axillary crease, whereas four nerves were located at the midhumeral level. **Conclusion:** The time to perform the block did not differ despite the approach used. The time to obtain complete sensory blockade of the brachial plexus was shorter for the axillary approach when compared to midhumeral approach. The success rate was significantly greater with the midhumeral approach. No differences in plasma concentrations of lidocaine were observed between the two groups and maximum concentrations remained under toxic thresholds ranging from 6 to 10 pg/ml. Motor block was more intense following midhumeral approach.

(3) FUZIER, MD, etal .A comparison between double-injection axillary brachial plexus block and midhumeral block for emergency upper limb surgery. (ANESTH ANALG 2006;102:1856 –8)

The prospective and randomized study, compared a double-injection axillary (median and radial nerves) block with a midhumeral block in 90 patients undergoing emergency upper limb surgery. Time to perform the block, success rate, and patient tolerance were evaluated. The time to perform the block was 5 min longer in the midhumeral group. The success rate was similar in both groups (80% and 91% in groups axillary and midhumeral respectively), except for the musculocutaneous nerve. Patient tolerance was better in the axillary group. Double-injection axillary brachial plexus block is superior to midhumeral block for emergency hand surgery

(4) BOUAZIZ H, NARCHI P, MERCIER FJ, et al. The use of a selective axillary nerve block for outpatient hand surgery.(ANESTH ANALG 1998;86:746–8)

The aim of this double-blind study was to block the radial (R) and musculocutaneous (MC) nerves with lidocaine, and the median (M) and ulnar (U) nerves with bupivacaine to recover motor function of the elbow and wrist more rapidly while maintaining long-lasting postoperative analgesia at the operative site. **Conclusion:** The recovery of motor function and time to

discharge were shorter compared with patients who received the mixture on all four nerves.

(5) KINIRONS BP, BOUAZIZ H, PAQUERON X, et al. Sedation with sufentanil and midazolam decreases pain in patients undergoing upper limb surgery under multiple nerve blocks. (ANESTH ANALG 2000;90:1118–21).

The efficacy of sufentanil 5 mg combined with midazolam 1 mg in decreasing pain in outpatients after a midhumeral multiple nerve stimulation

Technique is analysed. Visual analog scores for pain were significantly lower in those patients who received sedation before the block, both at the time of block performance and at discharge .

(6) BRIAN D. O'DONNELL, et al. AN estimation of the minimum effective anesthetic volume of 2% lidocaine in ultrasound-guided axillary brachial plexus block.

Ultrasound guidance facilitates precise needle and injectate placement, increasing axillary block success rates, reducing onset times, and permitting local anesthetic dose reduction. The authors performed a study to estimate the minimum effective anesthetic volume of 2% lidocaine with 1:200,000 epinephrinev (2% lidoepi) in ultrasound-guided axillary brachial plexus block.

***Conclusion**:* Successful ultrasound-guided axillary brachial plexus block may be performed with 1 ml per nerve of 2% lidoepi.

(7) MICHEL CARLES, MD, ALPHONSE PULCINI, MD, et al. An evaluation of the brachial plexus block at the humeral canal using a neurostimulator (1417 patients): the efficacy, safety, and predictive criteria of failure (ANESTH ANALG 2001;92:194 –8)

To evaluate the efficacy and safety of the multiple peripheral nerve block technique at the humeral canal (humeral block) with the use of a neurostimulator, prospectively studied 1417 patients undergoing upperlimb surgery with a brachial plexus block at the humeral canal (1468 blocks).

Conclusion: The humeral block is a reliable peripheral block allowing good success rates results with minor complications, which can be used as an alternative to the axillary block.

(8) DAVID SAMSON, MD ,VINCENT MINVILLE, MD, CLE´MENT CHASSERY, MD, et al. Eutectic mixture of local anesthetic (emla_) decreases pain during humeral block placement in nonsedated patients (ANESTH ANALG 2007;105:512–5)

The study evaluated the potential role of an euctectic mixture of local anesthetic (EMLA) cream application before performing midhumeral block. **Conclusion:** The patients who received EMLA cream had less pain with needle puncture as well as throughout the performance of humeral block.

MATERIALS

The following materials were needed for the study :

i. Injection lignocaine of 2% concentration – 15 ml

ii. Injection bupivacaine of 0.5% concentration – 15 ml

iii. Injection adrenaline used at dosage of 5 microgram / ml

iv. Injection midazolam at dosage of 20 microgram / kg

v. Injection fentanyl at dosage of 1 microgram / kg

vi. Sterile towels and 4*4 gauge packs

vii. One 20ml syringe for administration of local anaesthetic mixture

viii. Sterile gloves,Marking pens,and Surface electrodes

ix. One 25g needle for skin infiltration

x. **Nerve stimulator** - Stimuplex DigRc-B.Braun, Melsungen, Germany

xi. **Needle -** 22 gauge,50 mm-long, short bevelled insulated needle (Stimuplex Dig,B.Braun,Melsungen,Germany)

xii. Standard monitors – pulse oxymetry(SPO2),non invasive blood pressure(NIBP) and electrocardiogram(ECG).

xiii. Appropriate size endotracheal tubes and laryngoscopes

xiv. Working suction apparatus

xv. Intravenous fluids and intravenous cannula

xvi. All emergency drugs

METHODOLOGY

This study was a single blinded, randomized comparative study conducted in Government Stanley hospital, Chennai . After obtaining clearance from the Institutional Ethical Committee of the Stanley Medical College, Chennai-3, a pilot study was done to define the study population and decide on the inclusion and exclusion criteria. A target population of 100 patients was decided. After proper screening for the above mentioned criteria; the patients were informed about the purpose of the study, the procedure and the intended study methods on the day before surgery. An informed consent was obtained.

Inclusion criteria:

1. Both gender.
2. ASA physical status 1and 2.
3. Age 20 to 50 years old.
4. Weighing 40 to 70 kilograms.
5. Surgery of forearm, wrist or hand.
6. Elective surgery.
7. Patient given valid informed onsent

Exclusion criteria

1. Not satisfying inclusion criteria.
2. Lack of written informed consent.
3. Emergency surgeries.
4. Pregnancy.
5. Psychiatric illness.
6. Neuropathy.
7. Coagulopathy.
8. Infection at the puncture site.
9. Allergy to amide local anaesthetics.
10. Surgeries using Tourniquet

PROCEDURE

The selected patients were randomly assigned to two groups labeled as A and H. Each group was allotted 50 patients. Randomization was achieved by allotting lots with alphabets A and H.Patients with lot A assigned to group A. Those with lot H assigned to group H.

All the patients were fasted pre-operatively 6 hours for solids and 2 hours for clear fluids. Preoperative night sedation with tablet diazepam 5 mg was given to all patients. The procedure was carried out in the operation room where facilities for resuscitation are immediately available. Anaesthesia machine was

checked and resuscitative equipments and drugs were kept ready. The patients were brought to the operation room. Intravenous access was obtained with appropriate size venous cannula. Intravenous fluid was started. Standard monitors like Pulse Oximetry, Non Invasive Blood Pressure(NIBP), andElectrocardiogram (ECG) were connected. The baseline values were recorded. Injection Midazolam 20microgram/kg and Injection Fentanyl 1microgram/kilogram were given intravenously to all patients 15 minutes before performing the block .

The four injection brachial plexus block was performed by axillary approach in Group A and by humeral approach in Group H using the peripheral nerve stimulator . In both the approaches the median nerve, radial nerve, musculocutaneous nerve and ulnar nerve were identified by adjusting the needle through the same entry point.

TECHNIQUE OF BLOCK PERFORMANCE

(1) AXILLARY BLOCK

POSITION:

The block was performed with the patient in supine position, arm abducted 90°, externally rotated, elbow flexed 900 and forearm supinated.

PROCEDURE:

Under strict asepsis, the axillary artery was palpated at the level of the major pectoral muscle crossing the axilla. The subcutaneous tissue overlying artery was infiltrated with 5 ml of local anaesthetic mixture to anaesthetise the medial cutaneous nerves of the arm and forearm. A 22 gauge, 50mm long insulated short bevel stimulating needle was inserted at angle of 450 to the skin and connected to a nerve stimulator that was programmed with the following variables:current 2.0 milliamperes(mA) and frequency 2 Hertz(Hz).

MEDIAN NERVE:

The needle was inserted superior to the axillary artery to locate median nerve. The median nerve was identified by eliciting the flexion of the wrist , second finger and third finger. The motor response was produced by the contraction of the flexor carpi radialis muscle and flexor digitorum superficialis muscle. The current was reduced to 0.5 mA. The persistence of same motor response was

confirmed. A 5 ml of local anaesthetic mixture containing injection bupivacaine 0.25% and injection lignocaine 1 % with 5µg/ml of injection adrenaline was injected after negative aspiration test for blood .

MUSCULOCUTANEOUS NERVE:

The musculocutaneous nerve was identified by introducing the stimulating needle superior to the axillary artery with current of 2 mA. The flexion of the forearm was produced by the contraction of the biceps muscle innervated by the musculocutaneous nerve. The current was reduced to 0.5 mA and the same motor response was elicited.A 5 ml of local anaesthetic mixture containing injection bupivacaine 0.25% and injection lignocaine 1 % with 5µg/ml of injection adrenaline was injected after negative aspiration test for blood .

ULNAR NERVE:

The ulnar nerve was identified by introducing the stimulating needle inferior to the axillary artery with current of 2 mA . The flexion of the fourth finger and fifth finger was produced by the contraction of the flexor carpi ulnaris muscle. The current was reduced to 0.5 mA. The persistence of the same motor response was appreciated. A 5 ml of local anaesthetic mixture containing injection bupivacaine 0.25% and injection lignocaine 1 % with 5µg/ml of injection adrenaline was injected after negative aspiration test for blood.

RADIAL NERVE:

The radial nerve was identified by introducing the stimulating needle inferior to the axillary artery with current of 2 mA . The extension of the fingers was produced by the contraction of the extensor radialis muscle . The current was reduced to 0.5 milliamperes. The sustained extension of the fingers was appreciated.A 5 ml of the local anaesthetic mixture containing injection bupivacaine 0.25% and injection lignocaine 1 % with 5µg/ml of injection adrenaline was injected after negative aspiration test for blood.

(2) MIHUMERAL BLOCK:

POSITION:

The patient was made to lie in supine position with arm abducted to 90° and forearm stretched out and externally rotated.

PROCEDURE :

Under strict asepsis, the brachial artery was palpated at the junction between the upper and middle third of the arm .A 5 ml of the local anaesthetic mixture was injected subcutaneously on both sides of the brachial artery to anesthetize the median cutaneous nerves of arm and forearm .

MEDIAN NERVE:

The median nerve was located by inserting the needle almost tangentially to the skin between the brachial artery and the palpating finger in the direction of the brachial plexus. The needle was placed subcutaneously. The peripheral nerve stimulator was activated using a frequency of 2 Hz and intensity of 2 mA. The median nerve was identified by eliciting flexion of the wrist, second finger and third finger. The motor response was produced by the contraction of the flexor carpi radialis muscle and flexor digitorum superficialis muscle. The current was reduced to 0.5 mA. The presence of same motor response confirmed the proximity of the needle to the median nerve. A 5 ml of the local anaesthetic mixture containing injection bupivacaine 0.25% and injection lignocaine 1 % with 5µg/ml of injection adrenaline was injected after a negative aspiration test for blood.

ULNAR NERVE:

After anesthetizing the median nerve, the needle was reoriented. The needle was kept perpendicular to the operating table and medial to the artery. The ulnar nerve was identified by advancing the stimulating needle with current of 2 mA. The flexion of the fourth finger and fifth finger was elicited by the contraction of the flexor carpi ulnaris muscle. The current was reduced to 0.5 mA. The persistence of the flexion response was confirmed. A 5 ml of the local anaesthetic mixture containing injection bupivacaine 0.25% and injection lignocaine 1 % with 5µg/ml of injection adrenaline was injected after negative aspiration for blood.

MUSCULOCUTANEOUS NERVE:

The needle was reoriented. The tip of the needle was placed just under the biceps muscle and advanced over 2-4 cm to locate and anesthetize the musculocutaneous nerve. The current of 2 mA was used to elicit the flexion of the forearm. The contraction of the biceps muscle produced the motor response. The current was reduced to 0.5 mA. The same motor response was elicited.A 5 ml of the local anaesthetic mixture containing injection bupivacaine 0.25% and injection lignocaine 1 % with 5µg/ml of injection adrenaline was injected after a negative aspiration test for blood .

RADIAL NERVE:

The needle was removed to a subcutaneous position .The needle was introduced so that its tip being placed behind the humerus. Here the radial nerve lies in the spiral groove. The radial nerve was identified by introducing the stimulating needle with current of 2 mA. The extension of was produced by the contraction of the extensor radialis muscle. The current was reduced to 0.5 mA and sustained extensor response was elicited. A 5 ml of the local anaesthetic mixture containing injection bupivacaine 0.25% and injection lignocaine 1 % with 5µg/ml of injection adrenaline was injected after negative aspiration test for blood.

The patients in both groups received 25 ml of local anaesthetic mixture (15 ml of 2% of injection lignocaine with injection adrenalin 5µg/ml and 15 ml of 0.5% of injection bupivacaine). All the procedures were performed by the first author and assessed by a blinded investigator

A maximum time of 5 minutes was allowed to locate and perform injections for each nerve. Patients of both groups in whom all the four nerves were not localized were excluded from the study. Patients in whom the block was unsuccessful due to total failure or inability to locate the individual nerve within allotted time, which needed intravenous supplementation, individual nerve block at level of elbow or wrist or general anaesthesia were excluded from the study.

Pain and discomfort associated with the injections was assessed after completion of the block using the visual analog scale (VAS).

The sensory block was assessed in the areas supplied by the six nerves using the pointed tip of a 22 –gauge needle at 5, 10, 15, 20, 25, and 30 min after the end of the block procedure. The sensory areas used for assessment of the block were radial side of forearm for the musculocutaneous nerve, radial side of the dorsum of the hand for the radial nerve, the thenar eminence for themedian nerve, palmar aspect of the fifth finger for the ulnar nerve, ulnar side of the arm for the medial cutaneous nerves of the arm, and ulnar side of the forearm for the medial cutaneous nerve of the forearm.

The motor block was assessed at the end of 30 minutes from completion of the block procedure. The motor block was defined as either complete , satisfactory , or absent. In complete motor block, there were no movements against gravity below the elbow .In satisfactory motor block, minor movements of the digits were present. The full range of movements were present in case of absent motor block.

After the end of 30 minutes from completion of the block procedure, in case of incomplete block, the unblocked nerve(s) implicated in the surgical site were blocked at the elbow or wrist level.

During the intraoperative period , all the patients were monitored with ECG,NIBP and SPO2. At the end of the surgical procedure, all the patients were shifted to the postoperative ward .The patients were monitored with ECG,NIBP

and SPO2 in the post operative ward. When the patients complained of pain, the rescue analgesia was provided with intramuscular injection of tramadol at the dosage of 1 mg / kg.

PARAMETERS OBSERVED

1) Performance time

2) Onset time for sensory block

3) Onset time for median nerve block

4) Onset time for mucsulocutaneous nerve block

5) Onset time for ulnar nerve block

6) Onset time for radial nerve block

7) Complete sesory block at 30 min in percentage

8) Motor block (complete / satisfactory / absent)

9) Pain at block performance using Visual Analogue Scale(VAS)

10) Duration of post operative analgesia

11) Complications

DEFINITIONS:

1. **PERFORMANCE TIME(minutes)** The time to perform the block was defined as the time between the initial insertion of the needle to infiltrate the subcutaneous tissue overlying the artery and the removal of the insulated needle after completing the block procedure.

2. **PAIN AND DISCOMFORT AT BLOCK PERFORMANCE USING VISUAL ANALOG SCALE(VAS)**

3. **COMPLETE SENSORY BLOCK AT 30 MINUTES (percentage):** The block was defined as complete when loss of pinprick sensation was observed in all the sensory areas below the elbow at the end of 30 minutes after completion of block procedure.

4. **ONSET TIME FOR SENSORY BLOCK (minutes):** In patients in whom complete block was achieved, the onset period was measured between the end of the block performance and the onset of a complete sensory block.

5. **ONSET TIME FOR MEDIAN NERVE BLOCK(minutes):**The time from completion of block to loss of pinprick sensation in thenar eminence.

6. **ONSET TIME FOR MUSCULOCUTANEOUS NERVEBLOCK (minutes):** The time from completion of block to loss of pinprick sensation in radial side of forearm .

7. **ONSET TIME FOR ULNAR NERVE BLOCK(minutes):**The time from completion of block to loss of pinprick sensation in the palmar aspect of the fifth finger .

8. **ONSET TIME FOR RADIAL NERVE BLOCK(minutes):**The time from completion of block to loss of pinprick sensation in radial side of dorsum of hand.

9. **MOTOR BLOCK AT THE END OF 30 MINUTES**

   a. Complete- no movement against gravity.

   b. Satisfactory-minor movements of digits possible.

   c. Absent-normal range of movements present.

10. **DURATION OF POST OPERATIVE ANALGESIA(hours):**The time from completion of block to requirement of rescue analgesia.

11. **COMPLICATIONS :**

   1) Accidental vascular puncture
   2) Hematoma
   3) Anaphylaxis
   4) Local anaesthetic toxicity
   5) Infection of hematoma
   6) Neurological deficit.

OBSERVATIONS AND RESULTS

(1) AGE DISTRIBUTION

In Group A , minimum age of the patients recorded was 20 years and the maximum age was 50years .The mean age in Group A was **30.58** years, and standard deviation was 10.05. In Group H ,the minimum age of the patient was 20 years and maximum was 50 years. The mean age in Group H was **30.33** years, and standard deviation was 9.05.Both the groups were comparable with regard to age.

TABLE 1: AGE (YEARS)

Age distribution	**Group A**	**Group H**	**t-value**	**Significant value**
Mean	30.58	30.33	0.126	0.900 (not significant)
Standard deviation (SD)	10.05	9.05		

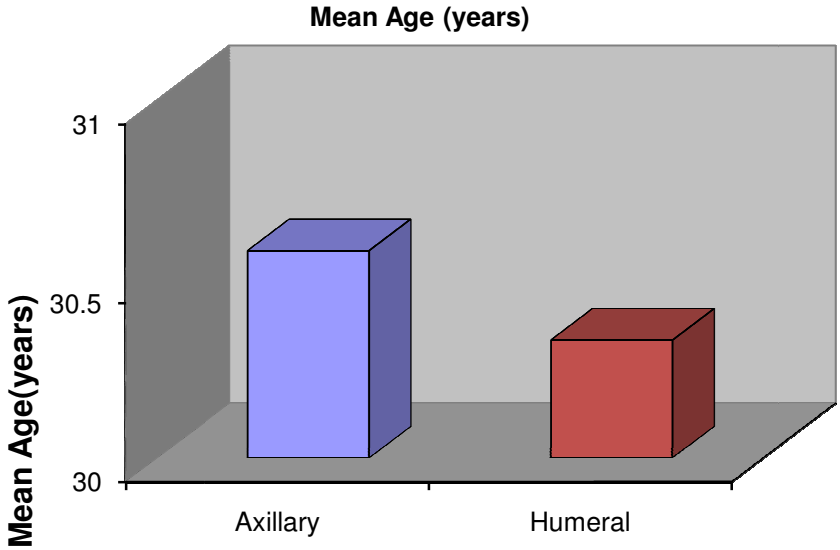

FIG-1: MEAN AGE(YEARS)

In Group A, there were 25 patients in the age group of 20 to 30 years , 12 patients in the age group of 31 to 40 years and 8 patients in the age group of 41 to 50 years .

In Group H, there were 28 patients in the age group of 20 to 30 years , 10 patients between 31 to 40 years and 8 patients in the age group of 41 to 50 years .Both the groups were comparable in terms of age distribution.

TABLE 2: AGE DSTRIBUTION

Age distribution	Group A		Group H		Chi square	Significant
	N	%	N	%		
20 – 30	25	55.60	28	60.90	1.407	0.704
31 – 40	12	26.70	10	21.70		
41 – 50	8	17.70	8	17.40		
Total	45	100	46	100		(not significant)

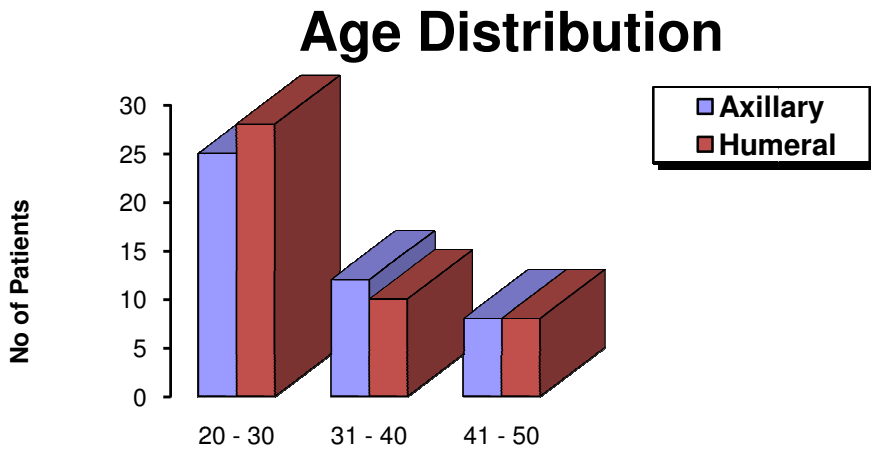

***FIG- 2:*AGE DISTRIBUTION**

(2) GENDER DISTRIBUTION

In Group A,there were 29 male patients and 16 female patients. In Group H,there were 30 male patients and 16 female patients. Both the groups were comparable in terms of gender distribution.

TABLE 3:GENDER DISTRIBUTION

Gender	Group A		Group H	
	No.	%	No.	%
Males	29	64.40	30	68.20
Females	16	35.60	16	34.80
Chi square value	0.006			
p-value	0.938 Not significant			

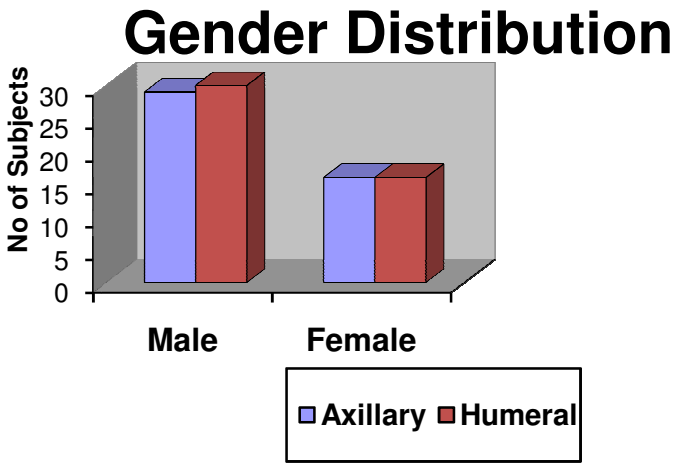

FIG – 3: GENDER DISTRIBUTION

(3)WEIGHT

In group A the minimum weight of the patient recorded was 40kg and maximum 65 kg. The mean weight in Group A was 51.14 kg with the standard deviation of 6.42 .

In group H,the minimum weight of the patient was 45 kg and maximum weight was 62 kg. The mean weight in group H was 51.66 kg,with the standard deviation of 2.57. The p- value was not significant.Both the groups were comparable in terms of weight

TABLE 4: WEIGHT IN Kg

Weight (kg)	**Group A**	**Group H**	**t-value**	**Significant Value**
Mean	51.14	51.66	0.532	**0.0.596 (Not Significant)**
Standard Deviation (SD)	6.42	2.57		

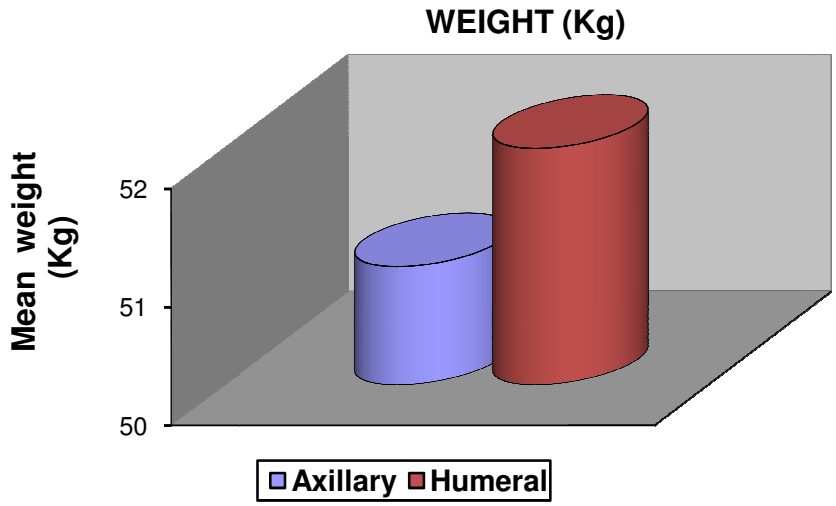

FIG 4: WEIGHT IN Kg

(4)SURGICAL SITE

In Group A , the number of surgical procedure done in hand were 43 and in forearm were 2.

In group H ,the number of surgical procedure done in hand were 41 and in forearm were 5.

TABLE 5: SURGICAL SITE

Surgical site	Group A	Group H
Hand	43	41
Forearm	2	5

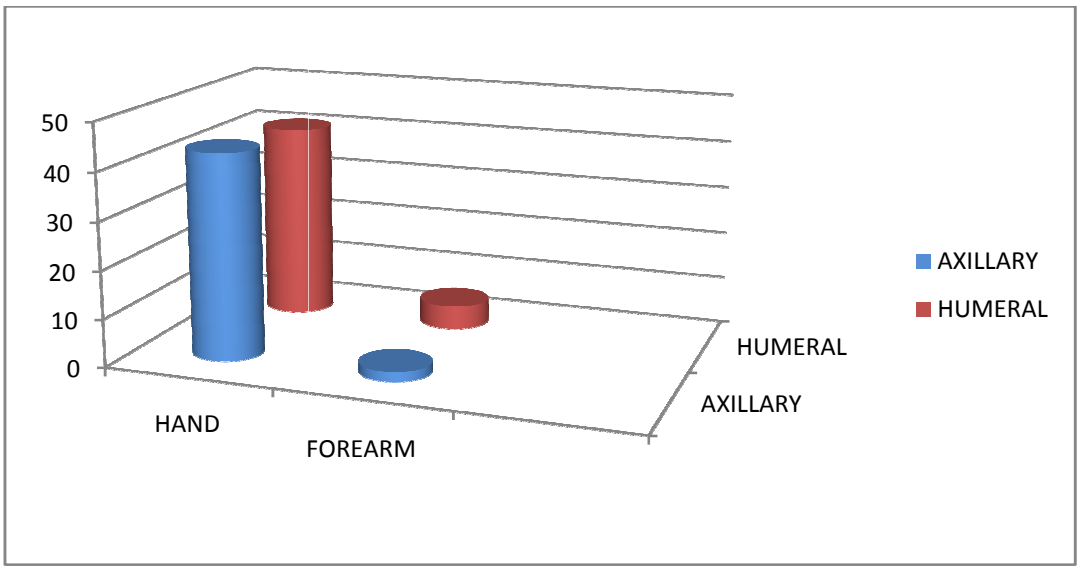

FIG 5: SURGICAL SITE

(5) PERFORMANCE TIME

In Group A ,the minimum time taken to perform the block was 4 minutes and the maximum time taken to perform the block was 10 minutes. The mean time taken to perform the block in Group A was 6.76 minutes with the standard deviation of 1.65. In Group H, the minimum time taken to perform the block was 4 minutes and maximum time taken to perform the block was 10 minutes. The mean time taken to perform the block in Group H was 7.35 min with the standard deviation of 1.86. On comparison ,p- value was not significant.

TABLE - 6: PERFORMANCE TIME

Time to perform block (in minutes)	**Group A**	**Group H**
Range	4-10	4-10
Mean	6.76	7.35
S.D.	1.65	1.86
t-value	**1.602**	
p- value	**0.113(not significant)**	

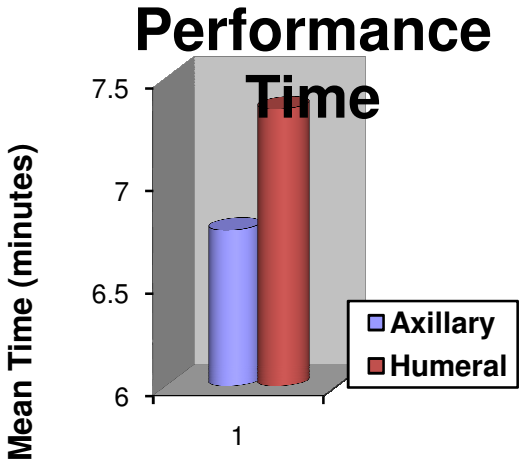

FIG 6:PERFORMANCE TIME(MINUTES)

(6)COMPLETE SENSORY BLOCK AT END OF 30 MINUTES

In group A, the complete sensory block at the end of 30 minutes of block procedure was seen in 45 patients and the block was incomplete in 5 patients .

In group H ,the complete sensory block at end of 30 minutes of the block procedure was seen in 46 patients and the block was incomplete blocks in 4 patients.On comparing two datas ,p -value was not significant.

TABLE-7:COMPLETE BLOCK AT THE END OF 30 MINUTES

Complete Block at end of 30 minutes	Group A		Group H		Total	
	N	%	N	%	N	%
Complete block	45	90	46	92	91	91
Incomplete block	05	10	4	8	9	9
Total	50	100	50	100	100	100
	Chi-square =0.614 **Significant value** =0.433(not significant) **Not significant**					

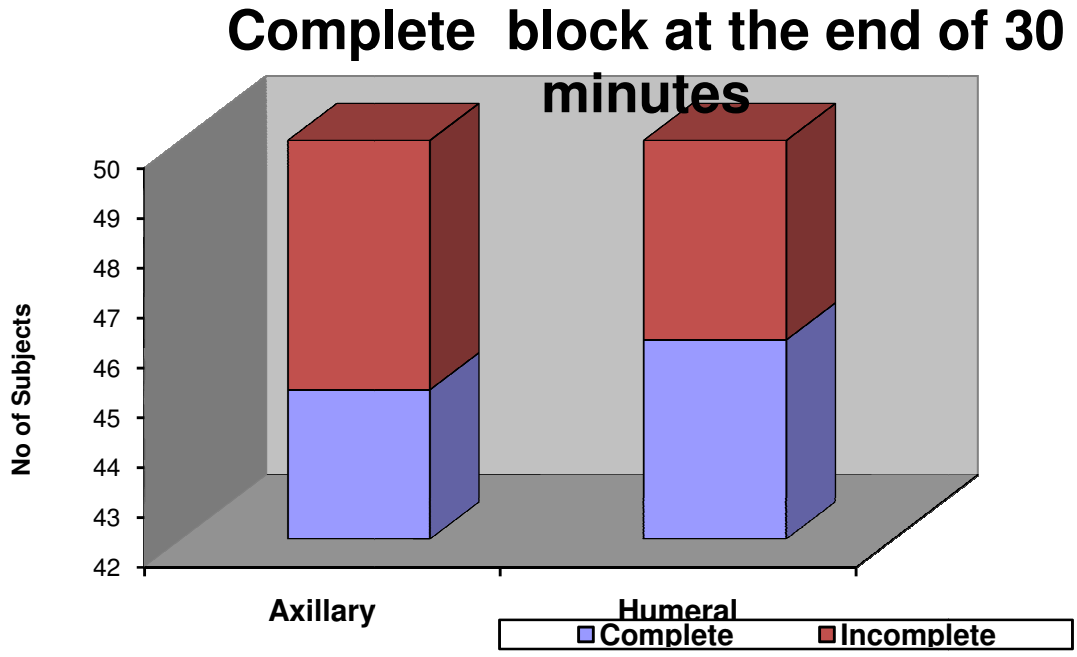

FIG 7:COMPLETE SENSORY BLOCK AT THE END OF 30 MINUTES

(7) ONSET TIME FOR SENSORY BLOCK

In group A, the onset time for the sensory block ranges from minimum of 5 minutes to maximum of 15 minutes with mean time of 9.44 minutes and standard deviation of 3.72 .

In group H, onset time for the sensory block ranges from minimum of 5 minutes to maximum of 20 minutes with mean of 10.87 minutes and standard deviation of 4.12 . On comparison ,p value was satistically not significant.

TABLE 8: ONSET TIME OF THE SENSORY BLOCK(MINUTES)

Onset time of sensory block (minutes)	**Group A N=45**	**Group H N=46**	**t-value**	**Significant value**
Mean	9.44	10.87	t=1.728	0.087 (Not significant)
Standard deviation (SD)	3.72	4.12		

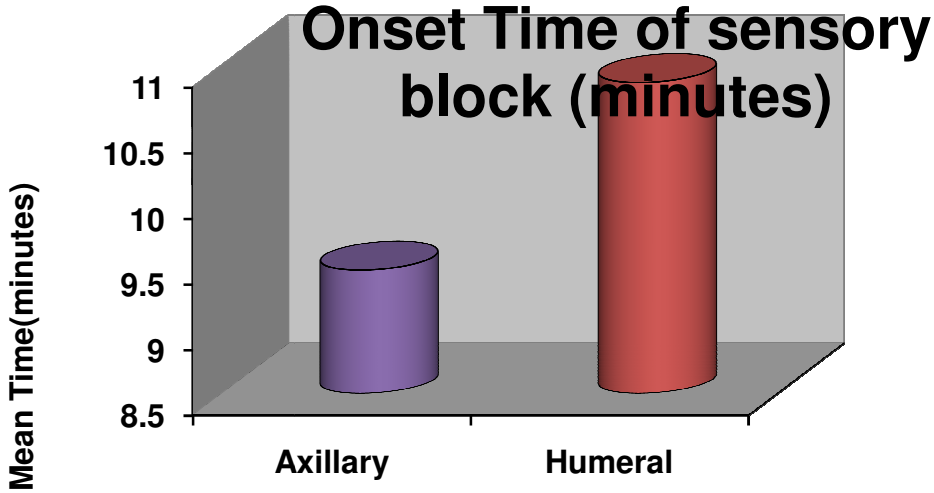

FIG 8: ONSET TIME FOR SENSORY BLOCK(MINUTES)

(8) ONSET TIME OF MEDIAN NERVE BLOCK

In group A, the onset time of median nerve block ranges from minimum of 5 minutes to maximum of 15 minutes with mean of 6.56 minutes and standard deviation of 2.98.

In group H , the onset time of median nerve block ranges from minimum of 5 minutes to maximum of 15 minutes with mean of 7.17 minutes and standard deviation of 3.60. On comparison, p-value wass not singnificant.

TABLE-9: ONSET TIME OF THE MEDIAN NERVE BLOCK(MINUTES)

Onset time for median nerve block (minutes)	**Group A N=45**	**Group H N=46**	**t-value**	**Significant value**
Mean	6.56	7.17	t=0.892	0.375 (not significant)
Standard deviation (SD)	2.98	3.60		

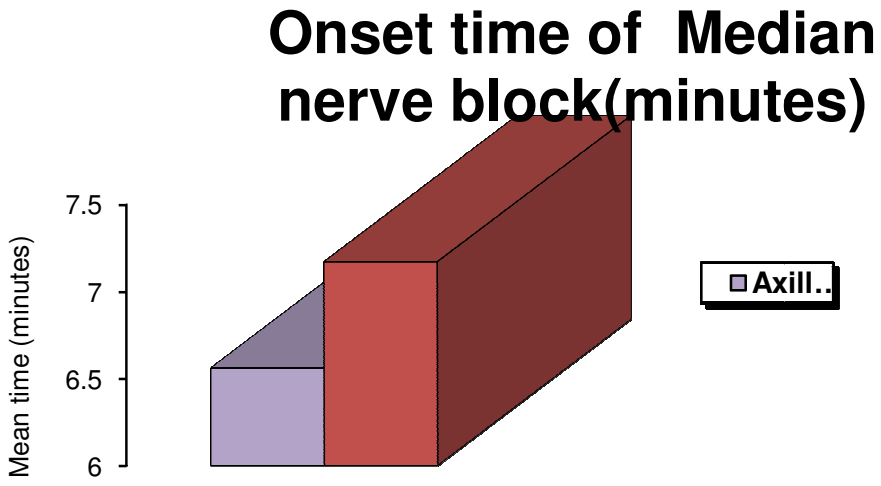

FIG 9: ONSET TIME FOR MEDIAN NERVE BLOCK(MINUTES)

(9) ONSET TIME OF MUSCULOCUTANEOUS NERVE BLOCK

In Group A,onset time of musculocutaneous nerve block ranges from minimum of 5 minutes to maximum of 15 minutes with mean time of 6.11 minutes and standard deviation of 2.98.

In Group H,the onset time of musculocutaneous nerve block ranges from minimum of 5 minutes to maximum of 15 minutes with mean time of 7.17 minutes and standard deviation of 3.60. On comparison ,p- value was not significant.

TABLE – 10:ONSET TIME OF THE MUSCULOCUTANEOUS NERVE BLOCK

Onset time for musculocutaneous nerve block(minutes)	**Group A N=45**	**Group H N=46**	**t-value**	**Significant Value**
Mean	6.11	7.17	t=1.615	0.110 (Not Significant)
Standard Deviation (SD)	2.98	3.60		

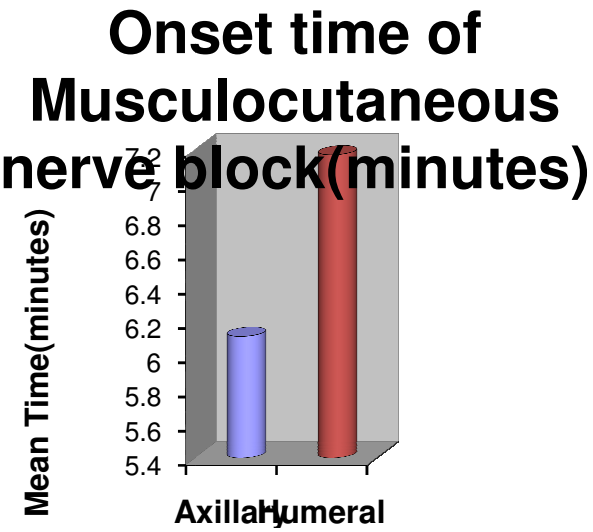

FIG 10: ONSET TIME OF THE MUSCULOCUTANEOUS NERVE(MINUTES)

(10)ONSET TIME OF ULNAR NERVE BLOCK

In group A, the onset time of ulnar nerve block ranges from minimum of 5 minutes to maximum of 15 minutes with mean time of 6.11 minutes and standard deviation of 2.80 .

In Group H,the onset time of ulnar nerve block ranges from minimum of 5 minutes to maximum of 20 minutes with mean time of 7.17 minutes and standard deviation of 3.50 . On comparison,p- value was not significant.

TABLE 11: ONSET TIME OF ULNAR NERVE BLOCK (MINUTES)

Onset time of ulnar nerve block (miutes)	**GroupA N=45**	**GroupH N=46**	**t-value**	**Significant value**
Mean	6.11	7.17	t=1.53	0.130 (not significant)
Standard deviation (SD)	2.80	3.50		

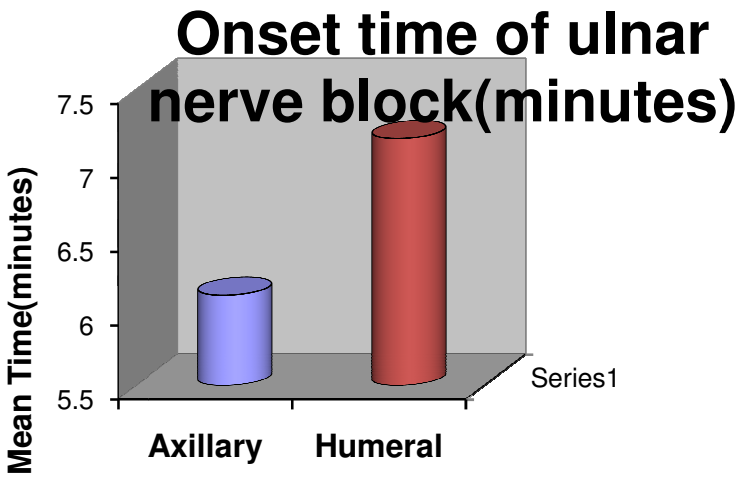

Figure 11-ONSET TIME OF THE ULNAR NERVE BLOCK

(11) ONSET TIME OF RADIAL NERVE BLOCK

In Group A , the onset time of radial nerve block ranges from minimum of 5 minutes to maximum of 15 minutes with mean time of 6.33 minutes and standard deviation of 2.69 .

In Group H ,the onset time of radial nerve block ranges from minimum of 5 minutes to maximum of 15 minutes with mean time of 6 .52 minutes and standard deviation of 2.55 .On comparison ,p- value was not significant.

TABLE 12:ONSET TIME OF THE RADIAL NERVE BLOCK (MINUTES)

Onset time of radial nerve block (minutes)	**Group A N=45**	**Group H N=46**	**t-value**	**Significant value**
Mean	6.33	6.52	t =0.346	0.7303 (not significant)
Standard deviation (SD)	2.69	2.55		

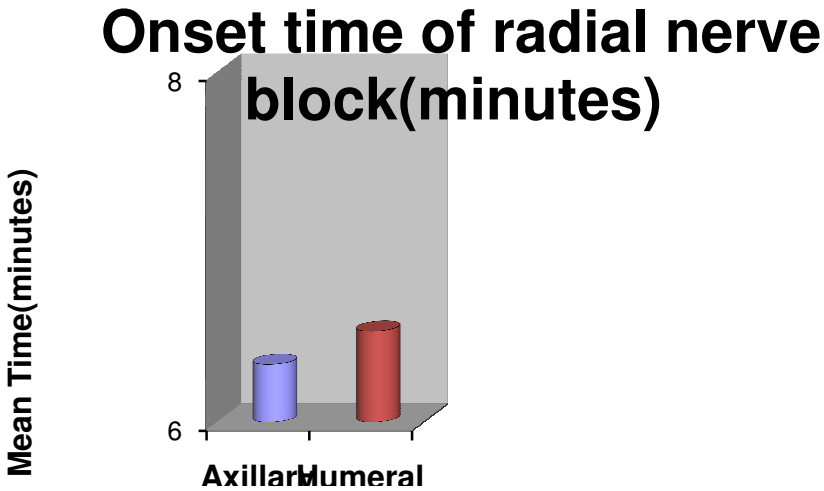

Fig 12:onset time of radial nerve block (minutes)

(12) VISUAL ANALOG SCALE AT BLOCK PERFORMANCE

In group A ,VAS score at the end of block performance ranges from minimum of 4 to maximum 9 with mean of 5.33 and standard deviation of 1.33.

In group H, VAS score at the end of block perfoemance ranges from minimum 4 to maximum 10 with mean of 6.76 and standard deviation of 1.68 . On comparison ,p- value is significant.

TABLE 13: VAS AT BLOCK PERFORMANCE

Pain at block performance(VAS)	**Group A N=45**	**GroupH N=46**	**T-value**	**Significant value**
Mean	5.33	6.76	t=4.493	0.0001 (significant)
Standard deviation (SD)	1.33	1.68		

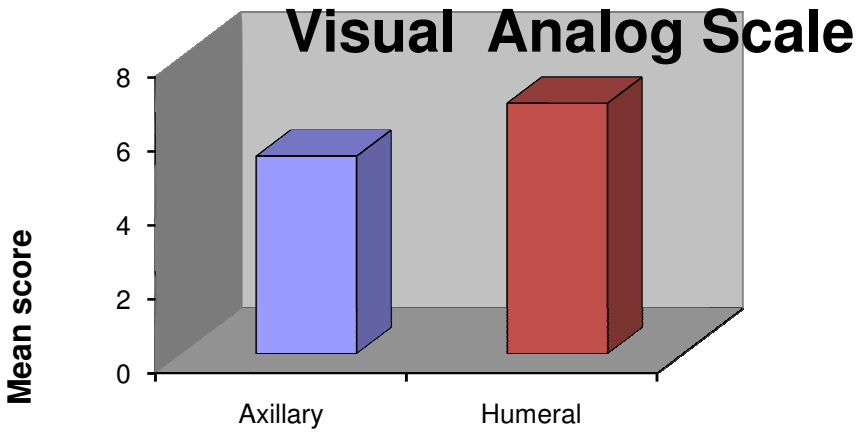

Fig 14:VAS at block performance

(13) DURATION OF POST OPERATIVE ANALGESIA

In Group A,the total duration of post operative analgesia ranges from minimum of 4 hours to maximum of 9 hours, with the mean time of 5.36 hours, and the standard deviation of 1.43 .

In Group H, the total duration of post operative analgesia ranges from minimum of 3 hours to maximum of 10 hours, with the mean time of 5.09 hours and the standard deviation of 1.59 .On comparison p value was not significant .

TABLE14: DURATION OF POST OPERATIVE ANALGESIA

Duration of post operative analgesia(in hours)	**Group A**	**Group H**
Range	3-10	3-10
Mean	5.36	5.09
Standard Deviation(SD)	1.43	1.59
T-value	**0.846**	
'p'	**0.400** **Not significant**	

FIG 14: DURATION OF POSTOPERATIVE ANALGESIA (HOURS)

(14) MOTOR BLOCK

In group A ,the motor block was complete in 38 patients and satisfactory in 12 patients.

In group H,the motor block was complete in 35 patients and satisfactory in 15 patients. On comparison ,the p –value was not significant.

TABLE 15:MOTOR BLOCK AT THE END OF 30 MINUTES

Motor	Group A		Group H	
	N	%	N	%
Complete	37	82	36	78
Satisfactory	8	18	10	28
Total	45	100	46	100
	Chi-square =0.457 **Significant value** =0.326 **Not significant**			

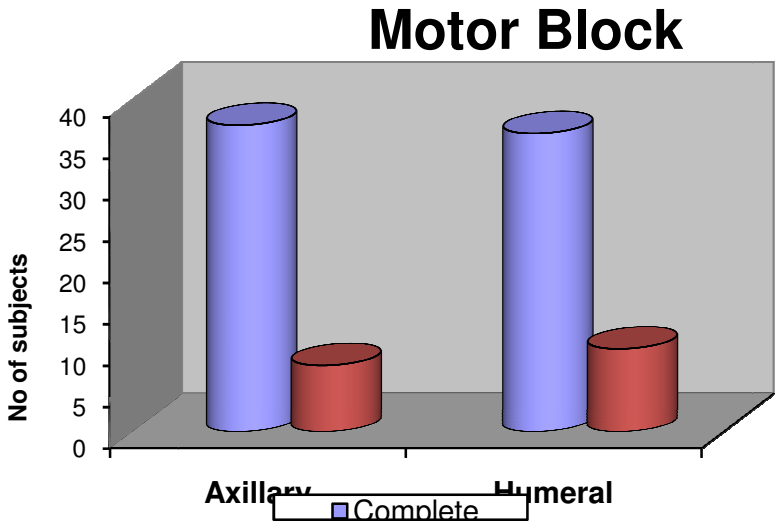

Fig 15:Motor Block

(15) COMPLICATIONS

In Group A ,the number of vessel punctures was 2. There were no vessel punctures in Group H.On applying chi square tests, the 'p' value was 0.138 which was statistically not significant. No other complication was recorded in both the Group A and Group H.

TABLE 16: COMPLICATIONS

Complications	Group A		Group H	
	No.	%	No.	%
Vessel puncture	2	4.45	0	0
No complications	43	95.55	46	100
Chi square value	2.056 Not significant			
'p' value	0.138 Not significant			

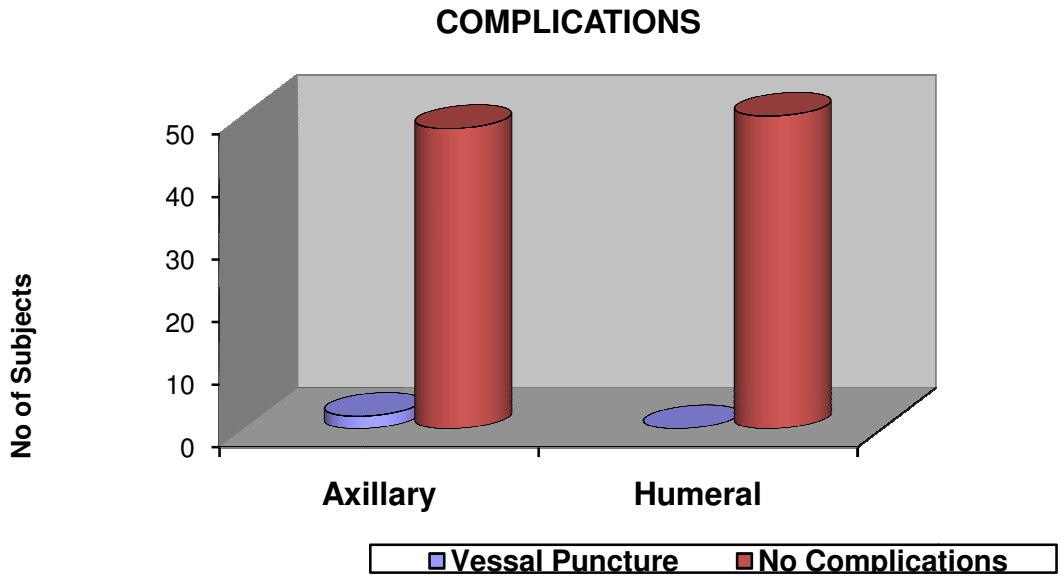

Fig 16:Complications

STATISTICAL TOOLS

The information collected regarding all the selected cases were recorded in a master chart. The observations were compiled and datas were expressed as mean ± SD. Quantitative analysis was compared with independent sample student's t-test. Qualitative analysis was compared with chi-square test. When using these tests to compare mean among two groups, p-value of less than 0.05 was taken as significant. All analyses were done using SPSS version 11.5 statistical software. All values were rounded off to a maximum of two decimals.

DISCUSSION(1-38)

The surgical procedures involving the hand, forearm, and elbow can be done by performing the brachial plexus block. Various approaches are available for blocking the brachial plexus at different levels. The success rate of the brachial plexus block varies depending on the type of approach used. The Axillary approach is one of the most commonly practised technique of brachial plexus block at the level of the axilla.This technique can be done by either eliciting paresthesia ,transfixation of the axillary artery , using peripheral nerve stimulator or ultrasound. Lavoie et al.(12) reported that when performing an axillary block using a peripheral nerve stimulator (PNS), stimulation of the musculocutaneous nerve, plus another nerve innervating the surgical site, resulted in a success rate similar to that obtained with the stimulation of all four major nerves at the axillary crease. The Humeral approach described by Dupre et al.(1) is a technique of multiple nerve blocks at the humeral canal with a neurostimulator . This approach provides a selective block of each major nerve from the brachial plexus and results in a high success rate .

Bouaziz et al.(2) compared axillary approach with humeral approach and reported that the humeral approach provided a greater success rate than the axillary approach . They compared the four-injection technique at the humeral level with the two-injection axillary block in which only the musculocutaneous nerve and another nerve innervating the surgical site were located and injected.

Several studies performed at the axilla demonstrated that a four-injection technique produced a rapid onset and frequent success .

Sia et al.(15) compared the axillary approach and humeral approach for the four injection brachial plexus block using peripheral nerve stimulator. He concluded that both the axillary and the humeral approaches provide a high success rate and rapid onset of sensory anaesthesia and the differences found between the two approaches were clinically not significant.

On the basis of these results , we decided to conduct this randomized, propective study to compare the onset time and the success rate of a four-injection technique of brachial plexus block performed using peripheral nerve stimulator at the axillary level with the humeral level.

To calculate the sample size of our study, we assumed that a 20% difference in success rate would be considered clinically important. To compare the two

groups with a power of 80% to detect a 20% difference in success rate at a significance level of < 0.05, the sample size required was 45 patients in each group. We enrolled 50 patients in each group to allow for dropouts. A total of 100 patients were included in the study.

The study population was designed by taking references from previous studies of Bouaziz et al.(2) and Sia et al (15).The patients of both the sexes in the age

group of 20 to 50 years weighing 40 to 70 kg were included in the study. The patients with contraindications for regional anaesthesia like coagulopathy, allergy to local anaesthetics, infection at puncture site, pre-existing neuropathy, psychiatric illness and pregnancy were excluded from the study. The brachial plexus block by both axillary and humeral approach can be performed in both the elective and emergency surgeries of the elbow, forearm and hand. In view of improving the standardisation of the study, only patients undergoing elective surgery of the elbow, ,forearm and hand were included in our study.

The lot method of randomisation was employed in this study. Randomization was achieved by allotting lots with alphabets A and H.The patients with lot A were assigned to group A. The patients with lot H were assigned to group H. The patients enrolled in Group A were allowed to undergo the four injection brachial plexus block by axillary approach . The patients enrolled in Group H were allowed to undergo the four injection brachial plexus block by humeral approach .

We decided to give intravenous(IV) sedation to all the patients 15 minutes prior to performing the block procedure .Injection midazolam 20 microgram/kg IV and injection fentanyl 1 microgram / kg IV was given to all the patients .This reduced the pain associated with the use of nerve stimulator. In Sia et al(15), Injection midazolam 20 microgram / kg IV and injection fentanyl 1 microgram / kg IV was given to all patients 5 minutes prior to performing the

block. In Bouaziz et al(2) , injection midazolam 1 mg IV and injection sufentanil 5 microgram IV was given to all patients prior to block procedure.

In our study , four- injection technique was performed at both the axillary level and humeral level .The same methodology was observed in Sia et al . In contrast, both Bouaziz et al.and Fuzier et al . compared a four -injection technique at the humeral level with a two- injection axillary block. In Bouaziz et al(2). the musculocutaneous nerve and another nerve innervating the surgical site were located and injected . In Fuzier et al. the median nerve and radial nerve were located and injected.

Many studies on axillary block have compared the multiple nerves stimulation technique with single stimulation ,paresthesia technique,and transarterial technique. Their results showed increased success rate with multiple nerve stimulation. Cuillerier et al used peripheral nerve stimulator for axillary block and obtained greater success with selective stimulation of the four major nerves when compared with traditional methods. Baranowski and Pither et al(24) . showed a greater chance of successful block with multiple paresthesia. From the results of the above studies, we decided to adapt four injection technique of blocking the brachial plexus using peripheral nerve stimulator.

The volume of local anaesthetic mixture used in our study was 25 ml. The local anaesthetic mixture was prepared by mixing 15 ml of injection lidocaine of 2%

concentration with injection adrenalin 5 microgram / ml and 15 ml of injection bupivacaine of 0.5% concentration. The resultant mixture contained 30 ml of injection lidocaine of 1% concentration and injection bupivacaine of 0.25% concentration. The weight of the patients included in our study was in the range of 40 kg to 70 kg. From the above preparation ,the amount of the local anaesthetic mixture administered to the patients were well within the allowable toxic limit.

Sia et al. used a mixture of equal parts of injection bupivacaine of 0.5% concentration and injection lidocaine of 2%concentration . Bouaziz et al. used 40ml of injection lidocaine of 1.5% concentration with injection epinephrine 1:200000 and 5 ml of injection lidocaine plain of 2 % concentration was used.Fuzier et al used 40 ml of injection ropivacaine of 0.75% concentration

In our study ,5 ml of the local anaesthetic mixture was used for skin infiltration on either side of the axillary artery in Group A and brachial artery in Group H to block the intercostobrachial nerve and medial cutaneous nerve of the arm and forearm. A 5 ml of local anaesthetic mixture was used to block each of the four major nerves namely median nerve,musculocutaneous nerve, ulnar nerve and radial nerve. A total of 25 ml of the local anaesthetic mixture was used in this study. Sia et al used 4 ml of local anaesthetic mixture for blocking medial cutaneous nerve of the arm and forearm, 10 ml each for blocking the radial nerve, ulnar nerve and median nerve and 6 ml for blocking the

musculocutaneous nerve.Bouaziz et al used 10 ml of the local anaesthesia for each of the four major nerves in the humeral approach . In axillary approach, he used 10 ml of the local anaesthesia for blocking the musculocutaneous nerve and 30 ml for blocking the second nerve involved in the surgical site. Fuzier et al in his study have used 10 ml of local anaesthetic solution for each of the four major nerves in the humeral approach. For the axillary approach, he blocked median nerve with 20 ml of the local anaesthetic solution and radial nerve with 20 ml of the local anaesthetic solution .

In our study testing for loss of pin prick sensation using pointed tip of 22 gauge needle was used to assess the sensory block. The loss of pinprick sensation in the sensory distribution of the four major nerves of the brachial plexus was assessed at the interval of 5 minutes for 30 minutes . At the end of 30 minutes, all patients with sensory loss below elbow were considered as complete block and rest as incomplete block. The same method was observed in Sia et al and Fuzier et al for assessing the sensory block. In contrast Bouaziz et al used light touch for assessing the sensory block. The concept of assessing the completeness of the sensory block at the end of 30 minutes from the completion of the block procedure was seen in all the studies .The same methodology was also adapted in our study.

The motor block was assessed at the end of 30 minutes from the completion of the block procedure in our study. The motor block was graded as complete,

satisfactory or absent depending upon the range of movements present at the end of 30 minutes. This was in agreement with the Sia et al.

Bouaziz et al. assessed the motor block every 5 minutes for 30 minutes from completion of the block procedure. He graded motor block as complete when there was no movement against gravity and incomplete, in the presence of movement of any degree. Fuzier et al assessed motor block every 5 minute for 30 minutes .He used scoring system of 0 for no motor block ,1 for minor movements and 2 for no movement.

The pain and discomfort at the completion of the block was assessed in our study using Visual Analog Scale(VAS). Fuzier et al employed a verbal rating scale from 1 for comfortable to 4 for intolerable pain. Sia et al used the Visual analog Scale (VAS) for describing the pain associated with the block procedure.

The parameters observed in this study were the time taken to perform the block, complete block at the end of 30 minutes from the completion of the block, onset time for the sensory block, onset time for median nerve block, musculocutaneous nerve block, radial nerve block and ulnar nerve block, VAS score at the completion of the block procedure ,motor block at the end of 30 minutes and duration of post operative analgesia. All the above parameters expect duration of post operative analgesia were studied in Sia et al.Bouaziz et al studied the time

taken to perform the block,sensory block and motor block and plasma concentration of lidocaine .

There were no demographic difference between the patients included in both the Group A and Group H.Axillary group and Humeral group were similar with respect to age(30.08+/-10.05 years versus 30.33+/-9.05 years) ,weight(51.14+/-6.42 kg versus51.66+/-2.57), .men/women ratio(29:16 versus 30:16) and surgical site(hand/forearm-43/ 2 versus 41/5).

Sia et al. reported the exclusion of 4 patients in axillary group and 2 patients in humeral group because all of the four nerves were not localised in the allotted time. The 4 patients in axillary group were excluded due to the difficulty in locting the ulnar nerve.In our study ,5 patients in Group A and 4 patients in Group H were excluded because complete sensory block below the elbow was not achieved at end of 30 minutes from block procedure. Fuzier et al .reported nil exclusion in his study.

SUCCESS RATE OF SENSORY BLOCK:

In group A , the complete block was achieved in 45 patients . Incomplete block was seen in 5 patients with persistence of pin prick sensation in sensory areas of musculocutaneous nerve in 2 patient, ulnar nerve in 2 patients and radial nerve in1 patient . In group H ,complete block was achieved 46 patients . Incomplete block was seen in 4 patients with persistence of pin prick sensation

in sensory areas of musculocutaneous nerve in 2 patient ,radial nerve in 1 patient and median nerve in 1 patient. In both the groups the patients with incomplete blocks were supplemented with blocking of that particular nerve at the level of elbow or wrist depending upon the type of surgery. The success rate of complete block for Group A were 90% and that for Group H were 92%. On comparison the differences were satistically not significant with p - value of 0.43($p>0.05$).The results were same as recorded in other studies. Sia et al. concluded that there was no difference in the success rate between the axillary group(91%) and humeral group (89%).This report was similar to that recorded in other studies using a four injection axillary or humeral approach. In contrast, Bouaziz et al stated that the success rate was more with humeral approach(88%) than a conventional axillary approach(54%).

TIME TO PERFORM BLOCK:

In group A, the time taken to perform the block were 6.7 +/- 1.65 minutes as compared to group H were the performance time were 7.35 +/- 1.86 minutes. The difference between the two groups were satistically not significant with p value of 0.113 ($p<0.05$).On an average of 7 minutes were observed to complete the block in both the groups. Sia et al. reported that the time taken to perform humeral block(7+/-2 minutes) was shorter than the time taken to perform axillary block (8+/-2 minutes). The reason for delay in performing the axillary block in Sia et al was due to the difficulty in locating the ulnar nerve. This problem was

not seen in our study. Bouaziz et al. took six minutes on an average to perform both the humeral block and the axillary block.

ONSET TIME OF SENSORYBLOCK

In our study, onset time were calculated only for patients with complete block at the end of 30 minutes. In Group A, onset time were 9.44+/- 3.72 minutes .In Group H the onset time were 10.87+/- 4.12 minutes . On comparison, the difference between the two groups were satistically not significant with the p- value of 0.087($p>0.05$).In conclusion, there were no difference in the onset time between Group A and Group H .The result was in agreement with Sia et al where there was no difference in the onset time between the axillary group(15+/-6 minutes) and humeral group (15+/-7 minutes). The onset time reported by Bouaziz et al. in humeral approach were 25+/-8 minutes and axillary approach were 15 +/-10 minutes. . Coventry et al. (13) showed that after a three-injection technique with 1.5% lidocaine with epinephrine blocks were complete in 47% of patients at 10 minutes and in 90% of the patients at 20 minutes. The difference in local anaesthetic solutions used in various studies produced difficulty in comparing the onset time.

ONSET TIME OF MEDIAN NERVE BLOCK:

In Group A, the onset time of the median nerve block were 6.56+/-2.98 minutes. In Group H the onset time of the median nerve block were 7.17+/-3.60 minutes . On comparison, the differences between the two groups were satistically not significant with the p value of 0.375($p>0.05$). The results were in agreement with Sia et al. No difference in the onset time of median nerve block was seen between the axillary group (14+/-6 minutes)and humeral group(14+/-8 minutes) in Sia et al.. We did not find the delay in the onset of sensory block of the median nerve recorded by Gaertner et al. (3).

ONSET TIME OF MUSCULOCUTANEOUS NERVE BLOCK:

In Group A , the onset time of musculocutaneous nerve block were 6.11+/-2.98 minutes .In Group H , the onset time of musculocutaneous nerve block were 7.17+/-3.60 minutes .The differences were satistically not significant with the p value of 0.110($p>0.05$). The results were in agreement with Sia et al and Bouaziz et al where there were no difference in onset time of musculocutaneous nerve between the axillary group and humeral group.

ONSET TIME OF ULNAR NERVE:

In Group A, the onset time of the ulnar nerve block were 6.11+/-2.80 minutes. In Group H ,the onset time of the ulnar nerve block were 7.17+/-3.50 minutes .The differences found on comparing the two groups were satistically not significant with the p value of 0.130($p>0.05$). Sia et al reported that there were no difference in onset time of ulnar nerve (Group A 12+/- 5 minutes vs Group H 15+/-6 minutes) between the axillary group(12+/-5 minutes) and humeral group (15 +/- 6 minutes).Sia et al. also reported a delay in identifying ulnar nerve in axillary group because of it deeper position at this level. This problem was not encountered in our study. A delay in the onset time of the ulnar nerve block with the humeral approach were reported by Bouaziz et al. (2).We did not find such type of delay in the onset time of ulnar nerve.

ONSET TIME OF RADIAL NERVE BLOCK:

In Group A, the onset time of radial nerve block were 6.33+/-2.69 minutes. In Group H, the onset time for radial nerve block were 6.52+/- 2.55 minutes. The differences found on comparison were satistically not significant with the p-value of 0.346($p>0.05$).In conclusion, there were no difference in the onset time of the radial nerve block in axillary group when compared with humeral group. The results were in agreement with that seen in Sia et al ,where there were no difference in the onset time of the radial nerve block between the axillary group (13+/-6 minutes) and humeral group(14+/-6 minutes).Bouaziz et al also

reported that there were no significant difference in the onset time of the radial nerve block.

MOTOR BLOCK:

In Group A, the motor block were complete in 37 patients and satisfactory in 8 patients.In Group H ,the motor block were complete in 36 patients and satisfactory in 10 patients .The differences found between the two groups were satistically not significant with the p value of 0.326($p>0.05$). Sia et al and Bouaziz et al also concluded that the motor block in both the axillary group and humeral group were comparable and equally effective.

VAS AT BLOCK PERFORMANCE

In group A ,the VAS at block performance were 5.33+/- 1.33 .In Group H the VAS at block performance were 6.76+/-1.68 .On comparison,the differences found were satistically significant with the p value of 0.0001 ($p<0.05$). In conclusion, the patient's pain score were significantly higher in humeral group The pain scores in Sia et al were significantly higher in group humeral than in group axillary.This might be explained by more peripheral approach to the four nerve in which the musculocutaneous and radial nerve lie deeper than that in the axilla. Our results were not in agreement with those reported by Kinirons et al.(16), who found that in patients sedated with midazolam and sufentanil had low pain scores in the humeral approach . This discrepancy might be

explained by a more effective sedation technique and by a significantly shorter performance time recorded in the study by Kinirons et al.(16)

DURATION OF POST OPERATIVE ANALGESIA:

In group A ,the duration of post operative analgesia were 5.36+/-1.43 hours as against group H where it was 5.09+/-1.59 hours .The diffirences on comparison were satistically not significant with the p value of 0.4($p>0.05$).The result was difficult to compare with result of other studies because of the difference in local anaesthetic solution used in different studies.

COMPLICATIONS

The number of vessel punctures in group A were 2 (4%). There were no vessel punctures in group H (0%). On applying chi square tests, the 'p' value were 0.138 which were statistically not significant($p>0.05$). The other complications like hematoma formation, allergic reactions to local anaesthetics ,cardiovascular and central nervous system toxicity to local anaesthetics, immediate and delayed nerve injury were not observed in the patients of both the study groups.Sia et al .reported vascular puncture, hematoma formation and symptoms of intravascular injection in both the study groups . No neurological complications were reported by Sia et al which was in agreement with our study.

SUMMARY

In this randomised prospective study,100 patients satisfying the inclusion criteria and undergoing surgeries below the level of elbow were randomly assigned into two groups, Group A and Group H. Of which , 50 patients received an four injection brachial plexus block by axillary approach in group A, and other 50 patients received block by humeral approach in Group H. The complete sensory block at the end of 30 minutes was seen in 45 patients of Group A and 46 patients of Group H.5 patients in Group A and 4 patients in Group H were excluded from the study due to lack of complete sensory block at end of 30 minutes.

Parameters observed were the block performance time ,VAS at block performance, complete block at the end of 30 minutes, onset time for complete block, onset time of median nerve block, musculocutaneous nerve block, ulnar nerve block and radial nerve block, duration of post operative analgesia, and block related complications like haematoma formation , vessel puncture, local anaesthesia related complications and nerve injury

The study shows that:

1. Time to perform block was not different in group A when compared to group H.

2. Complete block at end of 30 minutes was same in both groups

3. Onset time of complete block was same in both the groups.

4. Onset time for median nerve, musculocutaneous nerve and ulnar nerve and radial nerve were not different in both groups

5. *VAS* at block performance is *low in group A* as compared with group H.

6. The duration of post operative analgesia was not different in group A as compared with group H.

7. The incidence of complications in both groups were less.

CONCLUSION

From our study it was inferred that the differences found between the four injection brachial plexus block using peripheral nerve stimulator by axillary approach and humeral approach were clinically less significant. Both the approaches can be used for surgeries below the level of the elbow with similar success rate and complication rate using a peripheral nerve stimulator.

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PROFORMA

Patient Name : Age : Sex: Weight :

IP No: Date: Ward:

Comorbid Condition : ASA : MPC :

Diagnosis: Surgery: Duration:

Pre Block Parameter : PR- BP- SPO2- RR-

Anesthetic Procedure –

Concentration And Volume Of Drug Used :

S.NO.	**CHARACTERISTICS OF BLOCK:**	
1.	PERFORMANCE TIME(MINUTES)	
2.	VAS AT BLOCK PERFORMANCE	
3.	COMPLETE BLOCK AT END OF 30 MINUTES(PERCENTAGE)	
4.	ONSET TIME(MINUTES)	
5.	ONSET TIME OF MEDIAN NERVE(MINUTES)	
6.	ONSET TIME OF MUSCULOCUTANEOUS NERVE(MINUTES)	
7.	ONSET TIME OF ULNAR NERVE(MINUTES)	
8.	ONSET TIME OF RADIAL NERVE(MINUTES)	
9.	MOTOR BLOCK(COMPLETE/SATISFACTORY/ABSENT)	
10.	DURATION OF POSTOPERATIVE ANALGESIA(HOURS)	

COMPLICATIONS :

1.	Accidental vascular puncture
2.	Haematoma formation
3.	Nerve injury
4.	Anaphylaxis
5.	Local Anaesthetic toxicity
6.	Infection at the haematoma site
7.	Delayed neurological deficit

INTRA OPERATIVE MONITORING:

TIME SINCE PROCEDURE	SYSTOLIC BLOOD PRESSURE	DIASTOLIC BLOOD PRESSURE	HEART RATE	SPO2	RESPIRATORY RATE
5 MINUTES					
10 MINUTES					
15 MINUTES					
30 MINUTES					
45 MINUTES					
1 HOUR					
1 HOUR 30 MINUTES					
2 HOUR					

POSTOPERATIVE MONITORING IN WARD:

TIME SINCE PATIENT RECEIVED IN WARD(HOUR)	SYSTOLIC BLOOD PRESSURE	DIASTOLIC BLOOD PRESSURE	HEART RATE	SPO2	RESPIRATORY RATE
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

REMARKS :

ANAESTHESIOLOGIST SIGNATURE

S.NO	DATE	PATIENT NAME	AGE	sex	WT	DIAGNOSIS	SURGERY	IP NO	GROUP	SBP(mmHg)	DBP(mmHg)	HR(beat/m)	SPO2(%)	RR(bpm)
1	2.2.2011	PANDIAN	31	M	54	COMPOUND # 4 MC R HAND	DEBRIDEMENT, ORIF	315394	A	110	60	82	100	12
2	2.2.2011	ROHIT KUMAR	27	M	55	PTS L INDEX - FLAP DONE	SYNDACTYLY RELEASE	315546	H	108	65	73	100	13
3	3.2.2011	YOGANATHAN	20	M	42	LOCAL GIGANTISM L INDEX	CORRECTIVE REPAIR	314035	A	124	72	79	100	12
4	3.2.2011	PRAKASH	27	M	50	PTS - MALUNITED # MPX L MID, RING	ORIF	317858	H	122	64	81	100	15
5	3.2.2011	GANESAN	35	M	62	PTS R HAND # 4TH MC	ORIF	314541	A	117	66	82	100	16
6	4.2.2011	YUTHESH	20	M	48	CONST RING RHAND	RELEASE	309492	A	126	60	84	100	16
7	4.2.2011	SURESH	32	M	58	PIRA R HAND	SSG	3448	A	100	58	74	100	13
8	6.2.2011	BABU	20	M	48	PTS R HAND	FLEXOR RECONSTRUCTION	311333	H	107	72	69	100	14
9	7.2.2011	SILAMBARASAN	25	M	45	PT RA L HAND	FLAP COVER	318119	H	118	65	78	100	12
10	8.2.2011	RAM	38	M	57	PT RA R HAND	SECONDARY SUTURING	318052	H	114	60	69	100	12
11	10.2.2011	SELVAM	32	M	50	PTS R FOREARM	WOUND DEBRIDEMENT	312501	A	118	64	67	100	15
12	14.2.2011	JAYARANI	22	F	41	PTS L HAND	FLAP THINNING/ADVANCEMENT	3273	A	122	63	70	100	17
13	18.2.2011	POOMALAI	40	M	53	PTS L HAND	IP ARTHRODESIS/Z PLASTY	309804	A	124	66	77	100	16
14	22.2.2011	RAMASAMY	48	M	56	PIRA R FOREARM	FURTHER DEBRIDEMENT	317505	H	117	64	79	100	16
15	25.2.2011	BOOMILINGAM	22	M	49	SYNDACTYLY R INDEX AND MIDDLE	SYNDACTYLY RELEASE	303342	H	130	67	81	100	15
16	27.2.2011	KALIYAMMAL	38	F	48	PTS STIFF MP JOINTS R HAND	OPEN MP CAPSULOTOMY	298900	H	128	70	69	100	14
17	29.2.2011	SIVARAMAN	55	M		PT RA DORSUM R HAND	GROIN FLAP COVER	315430	A	118	70	84	100	13
18	1.3.2011	CHAKRAVARTHI	25	M	52	PTS R HAND	EXTENSOR TENOTOMY	313908	A	115	72	86	100	12
19	5.3.2011	ARUMUGAM	46	M	51	PTS R HAND	EXTENSOR TENOTOMY	4551	H	117	58	89	100	12
20	7.3.2011	ANUSHYA	40	F	56	PT RA R FOREARM	SSG	317565	H	114	60	88	100	12
21	10.3.2011	RAJAMANI	25	M	62	PT RA R FOREARM	SSG	317795	H	109	60	85	100	12
22	16.3.2011	SELVAMANI	32	M	60	PTRA R HAND	DEBRIDEMENT	315488	A	105	67	76	100	13
23	20.3.2011	AJITH	25	M	54	PTRA L LITTLE	SSG	315018	A	124	66	77	100	14
24	23.3.2011	JANAKI KUMAR	20	M	45	PBSC R LITTLE	RELEASE, Z PLASTY	315260	A	103	68	76	100	15
25	26.3.2011	POORNIMA	27	F	55	PTS - MALUNITED # MPX L MID, RING	ORIF	317867	H	102	64	78	100	16

S.NO	PT	C/IC	OT	MT	MCT	UT	RT	MOTOR	VAS
1	5	COMP	10	5	5	5	10	C	4
2	6	COMP	10	5	5	10	5	C	6
3	5	COMP	15	5	5	5	15	C	4
4	7	COMP	5	5	5	5	5	C	6
5	7	COMP	10	5	5	10	10	C	4
6	9	COMP	10	5	5	5	10	C	5
7	6	COMP	10	5	10	5	5	C	5
8	7	COMP	5	5	5	5	5	C	7
9	7	COMP	10	5	5	5	10	C	8
10	8	COMP	15	5	5	15	10	S	9
11	6	COMP	15	5	10	15	5	C	5
12	6	COMP	5	5	5	5	5	C	5
13	5	COMP	5	5	5	5	5	C	4
14	4	COMP	5	5	5	5	5	S	5
15	5	COMP	10	5	10	5	5	C	6
16	5	COMP	10	5	5	5	10	C	6
17	7	COMP	5	5	5	5	5	C	4
18	5	COMP	10	5	5	10	5	C	7
19	5	COMP	10	5	5	10	5	C	7
20	6	COMP	10	5	5	10	5	S	7
21	7	COMP	15	10	15	5	10	C	7
22	8	COMP	15	5	5	15	5	C	5
23	6	COMP	10	10	5	5		C	6
24	4	COMP	5	5	5	5	5	C	7
25	9	COMP	15	15	5	5	10	S	7

S.NO	SBP(mmHG)	DBP(mmHg)	HR(Beats/m)	SPO2(%)	RR(bpm)	DPA	COMPLICATIONS	SBP(mmHG)	DBP(mmHg)	HR(BEATS/M)	SPO2(%)	RR(bpm)
1	123-150	98-110	82-98	99-100	14-17	6	NIL	115-129	70-80	72-78	99-100	15-18
2	110-135	64-76	70-89	99-100	13 -17	4	NIL	108-133	77-89	77-95	99-100	15-19
3	108-124	62-78	68-80	99-100	13-15	5	NIL	113-128	65-78	76-95	99-100	16-17
4	105-132	64-86	66-85	99-100	13-18	5	NIL	103-128	64-75	83-99	99-100	13-17
5	112-137	65-88	72-88	99-100	14-18	5	NIL	117-138	62-70	72-86	99-100	13-17
6	115-138	64-79	62-73	99-100	14-17	5	NIL	114-129	60-73	70-88	99-100	15-17
7	113-124	65-78	72-80	99-100	14-19	5	NIL	113-126	75-88	72-90	99-100	15-18
8	118-134	68-77	64-72	99-100	13-18	4	NIL	112-120	69-78	79-92	99-100	13-17
9	112-130	75-88	70-85	99-100	15-20	4	NIL	124-137	70-88	88-100	99-100	13-17
10	116-129	66-79	75-88	99-100	14-18	5	NIL	108-120	71-89	72-95	99-100	14-18
11	110-125	69-78	62-70	99-100	13-16	5	NIL	105-113	72-85	70-88	99-100	14-17
12	118-135	79-90	70-82	99-100	13-17	5	NIL	109-119	75-90	70-83	99-100	14-16
13	112-128	65-78	70-88	99-100	16-18	4	NIL	105-117	100-112	75-90	99-100	13-17
14	113-126	68-79	72-85	99-100	16-19	5	NIL	113-126	102-110	77-95	99-100	13-18
15	112-136	72-96	75-86	99-100	14-19	5	NIL	112-133	78-95	72-85	99-100	15-18
16	114-128	78-86	77-90	99-100	15-17	5	NIL	115-136	75-90	80-93	99-100	13-17
17	113-136	77-95	77-89	99-100	13-16	4	NIL	108-128	58-60	68-74	99-100	14-17
18	115-129	75-89	75-86	99-100	14-17	3	NIL	110-135	76-90	77-90	99-100	14-18
19	108-133	77-96	76-95	99-100	13-19	5	NIL	113-126	77-95	71-88	99-100	14-17
20	113-128	72-80	72-80	99-100	14-17	5	NIL	147-160	70-95	70-86	99-100	14-16
21	103-128	76-90	70-99	99-100	14-18	4	NIL	145-158	72-86	72-88	99-100	15-16
22	117-138	82-96	75-90	99-100	15-19	4	NIL	116-129	77-89	72-90	99-100	13-16
23	114-129	79-86	64-78	99-100	14-15	3	NIL	122-136	76-90	70-89	99-100	15-17
24	113-126	76-80	65-77	99-100	13-16	6	NIL	102-110	73-90	72-95	99-100	14-17
25	112-120	70-80	72-78	99-100	13-18	4	NIL	113-130	71-80	66-80	99-100	14-17

S.NO	DATE	PATIENT NAME	AGE	sex	WT	DIAGNOSIS	SURGERY	IP NO	GROUP	SBP(mmHg)	DBP(mmHg)	HR(Beatpm)	SPO2(%)	RR(bpm)
26	30.3.2011	RANJANI	27	F	49	PTS L INDEX - FLAP DONE	SYNDACTYLY RELEASE	318846	H	115	65	73	100	17
27	5.4.2011	KRISHNAN	35	M	50	PBSC L HAND	SYNDACTYLY RELEASE	300765	A	118	62	75	100	18
28	7.4.2011	PAVITHRA	25	F	42	INGROWING NAIL R RING	EXCISION	315029	A	114	61	69	100	19
29	13.4.2011	JEEVA	42	M	52	CELLULITIS R FOREARM	DEBRIDEMENT	318163	H	109	66	69	100	12
30	15.4.2011	TAMILSELVAN	21	M	56	PTS SURGICAL SYNDACTYLY	RELEASE OF CONTRACTURE LITTLE FINGER	305110	H	105	69	68	100	13
31	18.4.2011	THRUVAN	46	M	55	FLEXION CONTRACTURE LITTLE	PIP ARTHRODESIS	313124	A	108	70	69	100	18
32	20.4.2011	SRINIVASAN	32	M	42	THUMB WEB CONTRACTURE R	RELEASE, Z PLASTY	303065	A	114	66	80	100	16
33	25.4.2011	RAGUPATHY	37	M	54	PT SYNDACTYLY R INDEX AND MIDDLE	RELEASE	314490	A	112	59	80	100	20
34	25.4.2011	MANIMARAN	45	M	60	SCAR FOREARM	SERIAL EXCISION	297118	H	105	70	82	100	21
35	27.4.2011	MD.IRBAS	32	M	57	PTSC LT LITTLE	RELEASE	308593	H	105	72	84	100	12
36	28.4.2011	KUNDAN PANDEY	20	M	49	PTS LT RING	PIP JT CAPSULOTOMY	311510	H	104	64	86	100	14
37	28.4.2011	MOORTHY	23	M	52	PTS SKELETAL R THUMB	CMC THUMB ARTHRODESIS	4693	A	114	65	87	100	13
38	29.4.2011	GAYATHRI	32	F	47	FLEXION CONTRACTURE L LITTLE	PIP ARTHRODESIS	315193	A	128	69	89	100	14
39	30.4.2011	M.BINDU	32	F	55	IMPLANTATION DERMOID LT HAND	EXCISION BIOPSY	318334	H	120	64	85	100	16
40	1.5.2011	HANSEKA	35	F	54	DISLOCATION LT 2 ND MCP	OPEN REDUCTION MCP LT HAND	318332	H	110	67	84	100	12
41	5.5.2011	BHASKAR	30	M	65	PTS R HAND	WRIST ARTHRODESIS	245693	A	117	60	85	100	11
42	8.5.2011	GUNALAN	50	M	65	SCAR R FOREARM	EXCISION	303347	A	118	69	87	100	16
43	9.5.2011	RAJA	23	M	42	MID PALMAR SPACE INFECTION	INCISION, DRAINAGE	315408	A	115	64	78	100	14
44	9.5.2011	CHINNADURAI	40	M	57	PYOGENIC GRANULOMA LT RING	EXCISION	318265	H	124	60	79	100	15
45	10.5.2011	JAYA	50	F	59	MOLE DISTAL FOREAARM RT	EXCISION	318336	H	128	66	78	100	14
46	10.5.2011	SEEMA RAMARAJ	47	M	58	INFECTED DERMOID HAND`	EXCISION	318392	H	120	68	69	100	13
47	11.5.2011	NANCY	20	F	41	PT RA R THUMB	SSG	312724	A	130	73	71	100	17
48	11.5.2011	MURALI	48	M	56	PTS SYNDACTYLY	RELEASE	314696	A	132	72	70	100	18
49	12.5.2011	GOMATHI	50	F	60	CELLULITIS L MID PALMAR SPACE	DEBRIDEMENT	315414	A	128	68	77	100	12
50	12.5.2011	AYISHA SIDDIKA	24	F	55	PBSC SURG SYNDACTLY RT MIDDLE AND RING	RELEASE	226341	H	128	65	74	100	13

S.NO	PT	C/IC	OT	MT	MCT	UT	RT	MOTOR	VAS
26	10	COMP	10	10	5	5	10	S	8
27	10	COMP	5	5	5	5	5	C	8
28	5	COMP	5	5	5	5	5	C	5
29	6	COMP	5	5	5	5	5	C	4
30	4	COMP	15	5	5	15	5	C	8
31	5	COMP	10	5	10	5	10	S	4
32	7	COMP	10	10	5	5	5	S	6
33	7	COMP	10	10	5	5	5	S	6
34	9	COMP	10	5	5	10	5	C	5
35	7	COMP	10	5	10	10	5	C	5
36	5	COMP	10	5	5	10	5	S	5
37	9	COMP	10	10	5	5	5	S	4
38	10	COMP	5	5	5	5	5	C	4
39	10	COMP	5	5	5	5	5	C	6
40	10	COMP	15	5	5	5	15	C	6
41	4	COMP	5	5	5	5	5	C	5
42	7	COMP	15	5	5	5	15	C	4
43	9	COMP	5	5	5	5	5	C	5
44	10	COMP	10	5	5	5	10	S	4
45	10	COMP	20	5	5	20	5	C	4
46	5	COMP	5	5	5	5	5	C	8
47	6	COMP	5	5	5	5	5	C	6
48	7	COMP	5	5	5	5	5	S	5
49	7	COMP	10	5	5	5	10	S	5
50	7	COMP	15	10	15	5	5	S	8

S.NO	SBP(mmHG)	DBP(mmHg)	HR(BEATSpm)	SPO2(%)	RR(bpm)	DPA	COMPLICATIONS	SBP(mmHG)	DBP(mmHg)	HR(BEATSpm)	SPO2(%)	RR(bpm)
26	124-137	77-89	77-95	99-100	16-19	3	NIL	109-128	72-90	66-79	99-100	15-18
27	108-120	65-78	76-95	99-100	14-18	5	NIL	116-129	76-89	69-78	99-100	14-18
28	105-113	64-75	83-99	99-100	15-18	4	NIL	113-136	72-88	74-89	99-100	13-17
29	109-119	62-70	72-86	99-100	15-19	3	NIL	108-135	65-80	70-86	99-100	14-17
30	105-117	60-73	70-88	99-100	16-17	3	NIL	113-130	77-93	72-88	99-100	14-18
31	113-126	75-88	72-90	99-100	13-17	4	NIL	109-128	75-88	70-84	99-100	13-17
32	112-133	69-78	79-92	99-100	13-17	3	NIL	116-129	80-92	72-90	99-100	14-18
33	115-136	70-88	88-100	99-100	15-17	6	NIL	113-136	82-90	77-90	99-100	15-17
34	108-128	71-89	72-95	99-100	15-18	3	NIL	108-135	80-96	70-88	99-100	16-17
35	110-135	72-85	70-88	99-100	13-17	3	NIL	112-126	72-90	72-88	99-100	13-17
36	113-126	75-90	70-83	99-100	13-17	6	NIL	112-129	78-86	70-84	99-100	13-17
37	147-160	100-112	75-90	99-100	14-18	7	NIL	113-129	65-72	68-83	99-100	13-15
38	145-158	102-110	77-95	99-100	14-17	5	NIL	113-126	64-72	67-84	99-100	14-18
39	116-129	78-95	72-85	99-100	14-16	3	NIL	114-138	70-80	70-88	99-100	13-17
40	122-136	75-90	80-93	99-100	13-17	10	NIL	112-130	64-70	75-95	99-100	13-18
41	102-110	58-60	68-74	99-100	13-18	4	NIL	116-129	60-75	67-87	99-100	14-16
42	113-130	76-90	77-90	99-100	15-18	5	NIL	113-129	56-68	74-87	99-100	14-16
43	109-128	77-95	71-88	99-100	13-17	6	NIL	112-125	64-79	68-83	99-100	14-16
44	116-129	70-95	70-86	99-100	14-17	10	NIL	114-128	63-77	65-79	99-100	14-16
45	113-136	72-86	72-88	99-100	14-18	4	NIL	120-135	60-72	63-83	99-100	15-17
46	108-135	77-89	72-90	99-100	14-17	4	NIL	124-136	62-80	71-87	99-100	15-17
47	112-126	76-90	70-89	99-100	14-16	6	NIL	120-133	64-70	67-89	99-100	15-17
48	112-129	73-90	72-95	99-100	15-16	9	NIL	115-128	65-75	64-89	99-100	13-17
49	113-129	71-80	66-80	99-100	13-16	5	NIL	110-136	68-75	64-88	99-100	14-19
50	113-126	72-90	66-79	99-100	15-17	6	NIL	124-130	64-79	68-89	99-100	15-17

S.NO	DATE	PATIENT NAME	AGE	sex	WT	DIAGNOSIS	SURGERY	IP NO	GROUP	SBP(mmHg)	DBP(mmHg)	HR(beats pm)	SPO2(%)	RR(bpm)
51	14.5.2011	HALAM	21	M	57	PTS EXCESS FLAP FINGERS	EXCISION OF EXCESS FLAP	311222	H	100	60	73	100	14
52	14.5.2011	NADHYA	20	F	42	PT RA R THUMB	SSG	315408	A	105	65	75	100	12
53	15.5.2011	KAVITHA	23	F	44	PT HTS R DORSUM	SCAR EXCISION AND CLOSURE	314696	A	117	64	64	100	13
54	15.5.2011	RAVANA	26	F	58	PBSC R HAND	SURG SYNDACTYLY RELEASE	307314	H	119	65	62	100	14
55	15.5.2011	SARVANAN	27	M	49	PTS LT HAND	WRIST ARTHRODESIS	314258	H	118	67	69	100	13
56	15.5.2011	REVATHI	26	F	52	PTS RT HAND	SCAR EXCISION	317692	H	115	61	74	100	15
57	16.5.2011	KAMESWARAN	21	M	53	RT TRIGGER THUMB	RELEASE	317980	H	117	62	78	100	16
58	16.5.2011	GUNA	50	M	65	CELLULITIS L HAND	DEBRIDEMENT	303347	H	118	69	87	100	16
59	16.5.2011	RAJAMMAL	23	F	48	R MID PALMAR SPACE INFECTION	INCISION, DRAINAGE	315482	A	119	65	88	100	14
60	17.5.2011	RANI	22	F	40	PT RA R HAND	DEBRIDEMENT	315558	A	124	66	90	100	12
61	17.5.2011	MURUGAN	46	M	55	PTS SKELETAL L HAND	WRIST ARTHRODESIS	4557	A	125	65	98	100	13
62	17.5.2011	MURALI	48	M	61	PTS LT HAND	FLAP THINNING	312295	H	119	65	77	100	16
63	17.5.2011	BALAKRISHNAN	33	M	57	PTS HAND RT	EXCISION SCAR FOREARM	398070	H	118	68	66	100	18
64	19.5.2011	RAVANA	26	F	58	PBSC RT HAND SYNDACTYLY	SURG SYNDACTYLY RELEASE	307314	H	114	69	75	100	16
65	25.5.2011	GURU	23	M	52	PTS SKELETAL R THUMB	CMC THUMB ARTHRODESIS	4098	A	113	70	87	100	17
66	25.5.2011	REVATHI	23	F	40	PT HTS R DORSUM	SCAR EXCISION AND CLOSURE	314696	A	112	63	65	100	15
67	2.6.2011	HITESHU	26	M	54	PEBSC LITTLE RT	RELEASE	302470	H	112	65	67	100	15
68	10.6.2011	SEETHA	27	F	50	INFECTED DERMOID RT HAND	EXCISION	318392	H	109	65	82	100	14
69	15.6.2011	MOHAN	48	M	55	PTS SYNDACTYLY	RELEASE	312295	A	105	64	84	100	15
70	24.6.2011	RAJA	37	M	48	PT SYNDACTYLY RT	RELEASE	312155	A	105	67	86	100	16
71	25.6.2011	SANDHYA	22	F	40	PISC R INDEX	RELEASE, CFF	303065	H	104	66	86	100	15
72	29.6.2011	NAZEEM	22	M	50	PT RA L HAND	DEBRIDEMENT	314258	H	120	60	88	100	17
73	4.7.2011	SANTOSH	22	M	49	PTS FLAP RT DONE	SYNDACTYLY RELEASE	315829	H	117	63	88	100	16
74	4.7.2011	CHRISTY	28	F	57	PBSC R HAND	RELEASE & FLAP COVER	313955	H	115	62	75	100	14
75	12.7.2011	FIAZ	31	M	48	PBSC L RING	RELEASE	1159	H	119	65	84	100	15

S.NO	PT	C/IC	OT	MT	MCT	UT	RT	MOTOR	VAS
51	8	COMP	5	5	5	5	5	S	7
52	8	COMP	10	5	5	10	10	C	3
53	4	COMP	15	5	15	15	10	C	4
54	8	COMP	15	5	5	5	15	C	7
55	8	COMP	10	10	5	5	5	C	9
56	8	COMP	10	10	5	10	5	C	9
57	9	COMP	15	10	5	15	5	C	10
58	7	IC	15	5	5		15	S	4
59	10	COMP	5	5	5	5	5	C	7
60	6	COMP	15	15	5	5	5	C	8
61	8	COMP	5	5	5	5	5	C	8
62	8	COMP	10	5	5	5	10	C	10
63	6	COMP	10	5	5	5	10	C	10
64	8	COMP	5	5	5	5	5	C	7
65	7	COMP	10	5	10	5	5	C	9
66	5	COMP	5	5	5	5	5	C	6
67	6	COMP	10	5	10	5	10	C	7
68	9	COMP	5	5	5	5	5	C	8
69	5	COMP	10	10	5	5	5	C	5
70	6	COMP	5	5	5	5	5	C	5
71	6	COMP	15	15	5	5	5	C	5
72	9	COMP	15	15	5	5	5	C	9
73	6	COMP	15	15	10	5	5	S	6
74	6	IC	10		5	10	5	S	7
75	6	COMP	15	15	10	5	5	C	6

S.NO	SBP(mmHG)	DBP(mmHg)	HR(BEATSpm)	SPO2(%)	RR(bpm)	DPA	COMPLICATIONS	SBP(mmHG)	DBP(mmHg)	HR(BEATSpm)	SPO2(%)	RR(bpm)
51	114-138	76-89	69-78	99-100	14-17	7	NIL	104-136	62-74	63-95	99-100	15-17
52	112-130	72-88	74-89	99-100	14-17	4	NIL	117-124	60-70	65-89	99-100	15-17
53	116-129	65-80	70-86	99-100	15-18	5	NIL	110-127	63-76	78-83	99-100	15-18
54	113-129	77-93	72-88	99-100	14-18	5	NIL	117-127	65-70	80-86	99-100	13-18
55	112-125	75-88	70-84	99-100	13-17	7	NIL	114-128	61-73	68-78	99-100	13-19
56	114-128	80-92	72-90	99-100	14-17	7	NIL	100-128	64-73	63-78	99-100	14-17
57	120-135	82-90	77-90	99-100	14-18	5	NIL	105-124	64-76	65-78	99-100	16-18
58	113-130	76-90	77-90	99-100	15-18	5	NIL	113-129	56-68	74-87	99-100	14-16
59	124-136	80-96	70-88	99-100	13-17	6	NIL	108-127	61-73	64-78	99-100	15-17
60	120-133	72-90	72-88	99-100	14-18	5	NIL	120-130	60-72	67-90	99-100	14-18
61	115-128	78-86	70-84	99-100	15-17	5	NIL	118-129	63-73	73-92	99-100	14-18
62	110-136	65-72	68-83	99-100	16-17	6	NIL	104-123	65-75	65-83	99-100	14-16
63	124-130	64-72	67-84	99-100	13-17	5	NIL	102-129	66-73	68-79	99-100	14-18
64	104-136	70-80	70-88	99-100	13-17	5	NIL	116-128	60-72	70-97	99-100	13-17
65	117-124	64-70	75-95	99-100	13-15	5	NIL	110-120	63-75	74-87	99-100	14-16
66	110-127	60-75	67-87	99-100	14-18	6	NIL	116-128	64-73	67-79	99-100	14-17
67	117-127	56-68	74-87	99-100	13-17	5	NIL	110-120	60-78	68-90	99-100	15-17
68	114-128	64-79	68-83	99-100	13-18	6	NIL	102-124	62-80	74-84	99-100	13-17
69	100-128	63-77	65-79	99-100	14-16	8	NIL	104-128	67-83	68-79	99-100	15-17
70	105-124	60-72	63-83	99-100	14-16	9	NIL	110-124	64-73	68-89	99-100	13-17
71	108-127	62-80	71-87	99-100	14-16	8	NIL	105-129	65-80	64-89	99-100	14-17
72	120-130	64-70	67-89	99-100	14-16	4	NIL	102-128	60-70	65-89	99-100	15-17
73	118-129	65-75	64-89	99-100	15-17	4	NIL	104-119	63-76	73-79	99-100	14-18
74	106-128	64-72	64-88	99-100	14-17	4	NIL	106-128	67-83	68-79	99-100	15-17
75	104-123	68-75	64-88	99-100	15-17	4	NIL	105-124	65-70	64-88	99-100	13-17

S.NO	DATE	PATIENT NAME	AGE	sex	WT	DIAGNOSIS	SURGERY	IP NO	GROUP	SBP(mmHg)	DBP(mmHg)	HR(beats pm)	SPO2(%)	RR(bpm)
76	12.7.2011	GUNA	50	M	65	CELLULITIS L HAND	DEBRIDEMENT	303347	H	118	69	87	100	16
77	20.7.2011	SAI	32	M	53	RT THUMB WEB CONTRACTURE	RELEASE, Z PLASTY	313124	A	120	67	64	100	15
78	20.7.2011	INDU	32	F	55	IMPLANTATION DERMOIDLT HAND	EXCISION BIOPSY	318334	H	120	64	85	100	16
79	24.7.2011	SAKTHIVEL	23	M	50	PBSC R MID & RING	CONTRACTURE RELEASE	316442	H	122	65	65	100	16
80	29.7.2011	ZIAUDHEEN	29	M	51	MALUNION 4TH RT MC	ORIF	317702	H	124	65	65	100	17
81	3.8.2011	BHASKAR	30	M	57	PTS R HAND	WRIST ARTHRODESIS	305222	A	117	69	76	100	18
82	14.8.2011	RANGA	23	M	55	LT MID PALMAR SPACE INFECTION	INCISION, DRAINAGE	315482	A	114	62	75	100	15
83	21.8.2011	RACHEL	20	F	42	PT RA R THUMB	SSG	315408	A	109	63	76	100	13
84	23.8.2011	RENUGA DEVI	41	F	51	PBSC R HAND	RELEASE & FLAP COVER	315688	H	103	70	73	100	12
85	23.8.2011	PANDEY	20	M	49	PTS LT RING	PIP JT CAPSULOTOMY	311510	A	104	64	86	100	14
86	23.8.2011	SEETHA	35	F	54	DISLOCATION MID LT MCP	OPEN REDUCTION MCP LT HAND	318332	A	110	67	84	100	12
87	30.8.2011	SAHIR	46	M	58	PTS SKELETAL L HAND	WRIST ARTHRODESIS	4557	A	100	64	77	100	15
88	3.9.2011	RAJESH	24	M	52	MALUNITED 4TH MC, STIFF MP RT	ORIF, MP CAPSULOTOMY	314749	H	106	65	7	100	14
89	12.9.2011	RAVEEN	24	M	47	SYNDACTYLY R HAND	SYNDACTYLY RELEASE	314750	H	117	65	75	100	12
90	22.9.2011	KIRAN	22	F	49	PT RA R HAND	DEBRIDEMENT	315558	A	110	66	76	100	13
91	27.9.2011	OVIYA	22	F	53	PEB LHAND	RELEASE AND SSG	316314	H	122	64	76	100	14
92	27.9.2011	MUTHU	23	M	52	PTS SKELETAL R THUMB	CMC THUMB ARTHRODESIS	4693	A	114	65	87	100	13
93	2.10.2011	MAYA	23	F	55	# PP THUMB	ORIF	317208	H	127	62	68	100	12
94	16.10.2011	BALAJI	21	M	55	HT SCAR R DORSUM	EXCISION & PRIMARY CLOSURE	318304	H	126	61	63	100	12
95	22.10.2011	ELLAMAL	27	F	55	SURGICAL SYNDACTALY RT THUMB AND INDEX	SYNDACTALY RELEASE	307705	A	125	66	65	100	15
96	30.10.2011	LOCHANA	23	F	53	TRIGGER THUMB R	TRIGGER RELEASE	318305	H	130	62	67	100	16
97	2.11.2011	PAMITHA	23	F	42	PBS L HAND	RELEASE & FTSG	314135	A	124	68	68	100	17
98	30.8.2012	POOVARASI	37	F	49	PTS SKELETAL L HAND	WRIST ARTHRODESIS	376991.8667	H	122	65	71	100	14
99	30.8.2012	SHANMUGAM	27	M	58	PT RA R THUMB	SSG	314056	A	113	64	63	100	16
100	30.8.2012	CHRISTY	28	F	57	PBSC R HAND	RELEASE & FLAP COVER	313955	A	115	62	75	100	14

S.NO	PT	C/IC	OT	MT	MCT	UT	RT	MOTOR	VAS
76	7	IC	15		5	5	15	S	4
77	8	COMP	15	15	5	5	5	C	5
78	10	IC		5	5	5	5	S	6
79	7	COMP	10	5	5	10	5	C	6
80	8	COMP	10	5	5	10	5	C	6
81	5	COMP	15	5	15	5	5	C	6
82	7	COMP	10	5	10	5	5	C	6
83	8	COMP	10	5	10	5	5	C	4
84	9	COMP	15	5	5	15	5	C	5
85	5	IC	10	5	5	10		S	5
86	10	IC	15	5	5		15	S	6
87	8	COMP	10	5	5	10	5	S	4
88	10	COMP	5	5	5	5	5	C	4
89	10	COMP	10	5	5	5	10	C	7
90	8	COMP	10	10	5	5	5	S	5
91	10	COMP	20	5	20	5	5	C	8
92	9	IC	10	10	5		5	S	4
93	4	COMP	15	10	15	5	5	C	9
94	5	COMP	10	10	5	5	5	C	6
95	6	COMP	10	10	5	5	5	C	6
96	7	COMP	15	15	5	5	5	C	5
97	9	COMP	10	10	5	5	10	C	5
98	8	COMP	15	15	15	5	10	C	5
99	6	IC	25		5	10	25	S	6
100	6	IC	10		5	10	5	S	7

S.NO	SBP(mmHG)	DBP(mmHg)	HR(BEATs pm)	SPO2(%)	RR(bpm)	DPA	COMPLICATIONS	SBP(mmHG)	DBP(mmHg)	HR(BEATS pm)	SPO2(%)	RR(bpm)
76	113-130	76-90	77-90	99-100	15-18	5	NIL	113-129	56-68	74-87	99-100	14-16
77	102-129	64-79	68-89	99-100	15-17	4	NIL	107-130	61-73	67-83	99-100	13-19
78	116-129	78-95	72-85	99-100	14-16	3	NIL	114-138	70-80	70-88	99-100	13-17
79	116-128	62-74	63-95	99-100	13-17	5	NIL	105-127	64-73	68-89	99-100	14-17
80	110-120	60-70	65-89	99-100	14-19	5	NIL	114-129	64-76	74-87	99-100	16-18
81	102-124	63-76	78-83	99-100	15-17	6	NIL	112-130	61-73	64-78	99-100	15-17
82	104-128	65-70	80-86	99-100	15-17	5	NIL	107-126	60-72	67-90	99-100	14-18
83	110-124	61-73	68-78	99-100	15-17	8	ACCIDENTAL VASCULAR PUNCTURE	105-125	63-73	73-92	99-100	14-18
84	105-129	64-73	63-78	99-100	15-18	5	NIL	107-129	65-75	65-83	99-100	14-16
85	113-126	75-90	70-83	99-100	13-17	6	NIL	112-129	78-86	70-84	99-100	13-17
86	122-136	75-90	80-93	99-100	13-17	10	NIL	112-130	64-70	75-95	99-100	13-18
87	102-128	64-76	65-78	99-100	13-18	7	NIL	110-120	66-73	68-79	99-100	14-18
88	104-119	61-73	64-78	99-100	13-19	5	NIL	105-129	60-72	70-97	99-100	13-17
89	105-124	60-72	67-90	99-100	14-17	5	NIL	110-124	63-75	74-87	99-100	14-16
90	107-130	63-73	73-92	99-100	16-18	5	NIL	104-129	64-73	67-79	99-100	14-17
91	105-127	65-75	65-83	99-100	15-17	5	NIL	110-125	60-78	68-90	99-100	15-17
92	147-160	100-112	75-90	99-100	14-18	7	NIL	113-129	65-72	68-83	99-100	13-15
93	114-129	66-73	68-79	99-100	14-18	6	NIL	103-125	62-80	74-84	99-100	13-17
94	112-130	60-72	70-97	99-100	14-18	7	NIL	106-128	67-83	68-79	99-100	15-17
95	107-126	63-75	74-87	99-100	14-16	6	NIL	104-123	64-73	68-89	99-100	13-17
96	105-125	64-73	67-79	99-100	14-18	8	NIL	103-125	65-80	64-89	99-100	14-17
97	107-129	60-78	68-90	99-100	13-17	5	ACCIDENTAL VASCULAR PUNCTURE	120-128	66-82	65-89	99-100	15-17
98	110-120	62-80	74-84	99-100	14-16	5	NIL	105-124	60-72	67-90	99-100	14-17
99	103-125	60-73	73-79	99-100	13-17	4	NIL	103-125	62-80	74-84	99-100	13-17
100	106-128	64-72	64-88	99-100	14-17	4	NIL	106-128	67-83	68-79	99-100	15-17

1	PT	PERFORMANCE TIME(MINUTES)
2	COMP	COMPLETE SENSORY BLOCK
3	IC	INCOMPLETE SENSORY BLOCK
4	OT	ONSET TIME OF SENSORY BLOCK (MINUTES)
5	MT	ONSET TIME OF MEDIAN NERVE BLOCK(MINUTES)
6	MCT	ONSET TIME OF MUSCULOCUTANEOUS NERVE BLOCK(MINUTES)
7	UT	ONSET TIME OF ULNAR NERVE BLOCK(MINUTES)
8	RT	ONSET TIME OF RADIAL NERVE BLOCK(MINUTES)
9	MOTOR	MOTOR BLOCK
10	C	COMPLETE MOTOR BLOCK
11	S	SATISFACTORY MOTOR BLOCK
12	VAS	VISUAL ANALOG SCALE
13	DPA	DIURATION OF POST OPERATIVE ANALGESIA(HOURS)
14	SBP	SYSTOLIC BLOOD PRESSURE(MM HG)
15	DBP	DIASTOLIC BLOOD PRESSURE(MMHG)
16	SPO2	OXYGEN SATURATION(%)
17	RR	RESPIRATORY RATE(BREATH PER MINUTE)
18	HR	HEART RATE(BEATS PER MINUTE)
19	RT	RIGHT
20	LT	LEFT
21	PBSC	POST BURN CONTRACTURE
22	PTRA	POST TRAUMA RAW AREA
23	PTSC	POAS TRAUMA SCAR CONTRACTURE
24	ORIF	OPEN REDUCTION AND INTERNAL FIXATION

÷{õ¯ õÎ uPÁÀ uõÒ

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INSTITUTIONAL ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : Comparison of axillary approach and Humeral approach By four injection brachial plexus block using peripheral Nerve stimulator

Principal Investigator : Dr.V.P.Senthil Kumar

Designation : PG in M.D (Anaesthesiology)

Department : Department of Anaesthesiology
Government Stanley Medical College,
Chennai-1

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 01.02.2011 at the Modernized Seminar Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate form the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

08/11/11

MEMBER SECRETARY,
IEC, SMC, CHENNAI

Dissertation On

"A COMPARISON OF AXILLARY APPROACH AND HUMERAL APPROACH FOR FOUR- INJECTION BRACHIAL PLEXUS BLOCK USING PERIPHERAL NERVE STIMULATOR"

ABSTRACT:

We conducted this prospective, randomized study to compare the success rate, performance time, and onset time of surgical anesthesia of a four-injection brachial plexus block performed at the axillary (Group Axillary; *n* = 50) or at the humeral (Group Humeral; *n* = 50) level using a peripheral nerve stimulator. All patients received 25 mL of a mixture of equal parts of 0.5% bupivacaine and 2% lidocaine. Five patients in Group Axillary and four in Group Humeral were excluded from the study because complete sensory block was not achieved in the allotted time. The incidence of complete block (90% versus 92%), defined as block of all the sensory areas below the elbow, and the onset time of sensory block (9.44+/-3.72 min versus 10.87+/-4.12 min) were not different between the groups. The performance time was same both Group Axillary and Group Humeral (6.76+/- 1.65 min versus 7.35+/- 1.86 min).The onset time for median nerve block, musculocutaneous nerve block, ulnar nerve block and radial nerve block were not different between the two groups. The duration of post operative analgesia(5.36 +/- 1.43 hours versus 5.09 +/- 1.59 hours) and motor block (complete :satisfactory = 37:8 versus 36:10) were same for both the groups. Block performance pain and discomfort assessed using visual analog scale was

lower in Group Axillary patients (5.33 +/-1.33 versus 6.76+/-1.68; $P < 0.005$). For four-injection brachial plexus block, we conclude that both the axillary and the humeral approaches provide a high success rate and a rapid onset of sensory anesthesia; the differences found between the groups could be considered clinically unimportant.

KEYWORDS:

Brachial plexus block, axillary approach, mid – humeral approach, success rate, brachial plexus block approaches.